RAILROAD GAZETTE

FRIDAY, SEPTEMBER 7, 1894.

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Contributions.

The Pull of Double Headers.

PITTSBURG, PA., July 28, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Some time ago in the *Railroad Gazette* I noticed the following question: "Does the front engine on a double header pull as much or more than the second engine, both being identical in weight and size?" One engine does not pull any more than the other, as they are both supposed to be working together; unless one engine has one of its sides on a "dead centre," then the other engine would pull more, but it would only be for an instant. Or in case one of the engines should break down on either side, the front engine or rear engine would then pull half as much again, as the other engine would only be doing half the work.

To illustrate this, say that two Pennsylvania Railroad Class "R" engines are hauling a draft of 50 cars and that the total weight hauled is 1,500 tons. The amount hauled by each engine would be 750 tons. When these engines are under full working pressure, the safety valve is set for 145 pounds, size of cylinders 20"x24". Now if one of these engines should break down *one side*, the other engine would have to haul 1,125 tons, or do half as much work again as the engine next to the train. Or in case (which is not likely) both engines break down on either side, then it would be just the same as if only one engine were hauling the train. W. C. H.

[Under the conditions of the question, that is, with both engines having the same rating as to power, it is not expected that one engine shall pull more than the other. The power of a locomotive in pulling is not constant for even a single revolution, as the pull is different for different positions of the crank pins. The pull also varies with the opening of the throttle, the steam pressure and the cut-off, therefore it will always happen that, owing to the varying nature of what is ordinarily considered a constant pull, either of two locomotives of a double-header may be pulling more at any given instant and the maximum pull will alternate from one to the other even when the average pull during a revolution is practically the same for both. However, in actual practice, it will not generally be found that the average pull is the same for both locomotives, as either engine may have more steam pressure, longer cut-off, wider open throttle or less internal friction. We suppose that the question was originally asked to learn whether it is intended that the front locomotive should pull more or less than the rear, and if any instructions are given to engineers in this matter. We do not know of a case where instruction of this kind is given.—EDITOR RAILROAD GAZETTE.]

The Future Freight Car.

TO THE EDITOR OF THE RAILROAD GAZETTE:

It frequently becomes necessary for me to know what will be the probable increase in rolling stock dimensions and weight in the near future; say in the next 20 years. I would like to have an expression of opinion from your readers as to the dimensions and weight and general features of freight cars as they will probably be built say 15 or 20 years from now.

CONSTRUCTOR.

Notes on German Railroad Practice—Train Service.*

BY MR. E. M. HERR.

The average passenger train in express service consists of from seven to eleven cars, depending on whether most of the cars have two or three axles. Only about 13 per cent. of the passenger equipment of the railroads of the German Empire has four axles and a proportionally small number of such cars are found in ordinary trains, nearly all being in express service. The ordinary or accommodation trains are principally made up of cars with two axles and average about ten cars per train. These express trains weigh, without passengers or baggage, from 100 to 180 tons, averaging about 140 tons. The accommodation trains, although longer, weigh about the same.

During the year 1891-2 each passenger on German express trains was carried an average distance of 72.36 miles, and on accommodation trains an average distance of 14.17 miles. On the railroads of the United States, during the same period, each passenger was carried an average distance of 23.82 miles, all kinds of train service being taken together.

The passenger as well as freight service, on German lines, is, in general, slower than on American roads. Express trains will not average much over 30 miles an hour, and ordinary passenger trains will not exceed an average speed of 21 miles an hour between terminals. Both these speeds include stops, which of course are very frequent on the ordinary or accommodation trains, and comparatively infrequent in express service, although even in this service many more stops are made than on American lines. The fastest express trains in Germany are those on the principal lines of the Prussian roads, those on south German roads being much slower. The two fastest trains are now running on the Hamburg-Berlin line, making the run between these two cities, a distance of 177½ miles, at an average speed of 49 miles an hour. Two express trains are run each way over this line, one, a limited train on which an extra rate of fare is charged, makes the run at the above mentioned speed with one stop; the other, with two more stops, averaging 45 3 miles an hour. Three other express trains are also run over this line, but at a lower average rate of speed. The principal lines between Berlin and Cologne have perhaps the next best express service in Germany. Here, however, the average speed, including stops, seldom exceeds 36 miles an hour. The stops are more frequent than on the Hamburg line, but the average speed, exclusive of stops, does not reach 48 miles an hour between stations, and will not average more than 42 miles an hour between terminals.

The most important through express in Southern Germany is the Oriental Express, running from Paris to Constantinople and passing en route through Baden, Würtemberg and Bavaria. The running time varies somewhat in these different countries, as each has its separate management and operates independently, although in conjunction with the others. Engines and train crews are changed at the frontier of each country, but the train is not broken. The actual running time of this train through Germany, not including stops, varies from 31 to 37 miles an hour. The lower speed is made through Würtemberg, where an average of 32 miles an hour is seldom exceeded. Through Bavaria the time is fastest, reaching for one run of about 40 miles, an average of 38 miles an hour. Through Austria 35 miles an hour is not exceeded and seldom reached.

For the purpose of comparing the passenger train service in Germany and the United States, all the regular passenger trains, both express and accommodation, running between Hanover and Bielefeld on the Prussian line between Berlin and Cologne, are compared below with trains of the same class running between Chicago and Earlville on the Chicago, Burlington & Quincy, main line between Chicago and Galesburg. This service was selected on account of the distance being exactly the same in both cases, viz., 68 miles, and the grades and curves both being light and quite similar, while both lines are at least double track throughout. The time and distance on the Burlington are taken between Western Avenue Station and Earlville, Chicago, as between Western avenue and the Union Station many streets are crossed at grade and speed must be greatly reduced, while in Hanover the trains enter the city on an embankment with no grade crossings, and speed can be maintained until the principal station is reached.

PASSENGER TRAINS BETWEEN HANOVER AND BIELEFELD — PRUSSIAN GOVERNMENT RAILROAD.

Express Trains	Time card time, incl'd'g stops, mins.	117	113	137	118	....	....
	Number of stops	3	4	6	3	....	....
Hanover to Bielefeld	Average speed, miles per hour	34.86	36.10	29.78	34.57	....	....
Do.	Time card time, incl'd'g stops, mins.	182	192	196	196	190	175
Accd'n	Number of stops	15	15	14	15	13	12
Trains	Average speed, miles per hour	22.38	21.25	20.82	20.82	21.47	23.3$_8$
Bielefeld to Hanover	Time card time, incl'd'g stops, mins.	127	111	112	110	....	....
	Number of stops	6	3	6	4	....	....
Express Trains	Average speed, miles per hour	32.10	36.75	36.43	37 08	....	....
Do.	Time card time, incl'd'g stops, mins.	191	185	185	194	164	181
Accd'n	Number of stops	14	14	14	13	15	14
Trains	Average speed, miles per hour	21.36	22.05	22.05	21.03	24.88	22.55

PASSENGER TRAINS BETWEEN CHICAGO AND EARLVILLE— CHICAGO. BURLINGTON & QUINCY RAILROAD.

Chicago to Earlville	Time card time, incl'd'g stops, mins.	89	99	97	134	....	....
	Number of stops	1	1	1	3	....	....
Express Trains	Average speed, miles per hour	47.19	41.20	42.06	30.45	....	....
Do.	Time card time, incl'd'g stops, mins.	142	155	150	....	....	....
Accd'n	Number of stops	13	8	9	....	....	....
Trains	Average speed, miles per hour	29.78	30.45	30.18	....	....	....
Earlville to Chicago	Time card time, incl'd'g stops, mins.	136	107	120	121	....	....
	Number of stops	3	1	1	1	....	....
Express Trains	Average speed, miles per hour	32.1	40.38	38.82	36.43	....	....
Do.	Time card time, incl'd'g stops, mins.	144	162	145	....	....	....
Accd'n	Number of stops	9	8	13	....	....	....
Trains	Average speed, miles per hour	30.91	28.32	28.74	....	....	....

The above table shows that in express service the average speed is considerably higher on the Chicago, Burlington & Quincy than on the Prussian road compared with it. But, although the average speed, as shown by the time card, is considerably higher on the Chicago, Burlington & Quincy, the stops are fewer. Allowing three minutes lost by each stop, were the same number of stops made without exceeding the present actual speed as are made by corresponding German trains, the time card time would average almost the same, being faster in one direction and slower in the other. Making the same comparison for the local trains, it will be seen that the Chicago, Burlington & Quincy trains in both directions are considerably faster, their equated average speed ranging from 25 to 29 miles an hour, against 21 to not quite 25 miles an hour in Germany. It should be stated, however, that while the express service shown is exceptionally good for the German lines, being much above the average, that on the Chicago, Burlington & Quincy is only fairly average American express service.

The average weight of cars in the German express and accommodation trains in the above table probably exceeds the general average of 140 tons, but does not exceed in any train 190 tons. On the Chicago, Burlington & Quincy the empty cars in express trains average 265 tons, some trains exceeding 350 tons, while the accommodation trains average about 195 tons empty. The German express trains are hauled by two-cylinder Von Borries compound locomotives, weighing 99,240 lbs., with 66,000 on drivers, the accommodation trains, usually with compound engines, weighing 86,880 lbs., with 58,870 lbs., on drivers. The engines hauling the Chicago, Burlington & Quincy express trains are of two types, one a mogul weighing 110,000 lbs., with 92,000 on the drivers, the other an eight-wheeler, weighing 100,000 lbs., with 66,000 lbs., on drivers. The accommodation trains are hauled by an eight-wheel engine weighing 81,000 lbs., with 54,400 lbs. on the drivers.

It therefore appears that although the American locomotives are heavier in express service than the German, they are not proportionately as powerful when the weight of the train is considered, and that with a much heavier accommodation train the service is performed with a lighter engine. The important fact that the locomotives on the German lines are usually worked much easier than those on American railroads is at once noticed in traveling throught hat country. The express locomotives running from Hanover through Beilefeld, make a average mileage of 4,650 miles per month, which is there considered large mileage even for express engines. Engines in express service are now commonly double-crewed, although in nearly all other kind of service they are only single-crewed. Pooling the engine crews and engines is unknown in German practice. The average monthly mileage of the Chicago, Burlington & Quincy express passenger engines on the Chicago through Earlville runs is 8,300 miles, some of them making regularly upwards of 9,000 miles per month.

The movement of freight on the German lines differs more from American practice, from the train service standpoint, than the movement of passengers. The cars are small, rarely exceeding 16 tons capacity, and although the average train hauled consists of 34 cars, the weight is small, averaging less than 430 tons. The speed is slow, rarely exceeding 15 miles an hour and averaging much less. The lower speed of freight trains and the much more general use of block signals and avoidance of grade crossings, together with a better policing of the lne, is probably the reason that accidents in train serivce are much less frequent and disastrous to life and property on German than on American railroads.

During the year 1892 on the railroads comprised in Group III of the United States Interstate Commerce Commissioners reports, including a mileage of 21,935 miles of railroad, there were casualties as follows:

	Killed.	Injured.
Passengers	52	520
Employees and others	1,158	6,042
Total	1,210	6,562

During the same period on all the railroads of the German Empire, including a mileage of 26,207 miles of line, the following casualties occurred:

	Killed.	Injured.
Passengers	46	153
Employees and others	437	2,185
Total	483	2,338

Per mile of road therefore on the American railroads about three times as many lives are lost and injuires inflicted as on the German roads. Owing to the greater speed and size of our trains, the accidents per ton or passenger mile per mile of line would not show quite so unfavorably, but even when thus compared the Ameri-

*For earlier articles in this series see pages 544 and 559.

can roads are disgracefully far behind those in Germany.

In an admirable paper by Regierungsbaumeister Petri of the Prussian railroads, recently published in *Stahl und Eisen*, is the following table, giving a comparison between the freight traffic of the German railroads and that of a portion of those in the United States lying in a territory fairly comparable with that served by the Gerarnn lines.

	United States, 1890.		German Lines, 1889-90.
	Group II.	Group. III.	
Length of line, miles..	18,600.	21,575.	24,870.
Freight ton miles per mile of line.....	840,770.	492,160.	370,640.
Average train load, net tons.....	218.	218.	175.
Average distance each ton is handled, miles.	95.5	120.25	63.9
Revenue per ton mile, cents.....	1.	0.83	1.6
Cost per ton mile, cents	0.63	0·56	0.67

Group II includes the railroads of New York, New Jersey, Delaware, Maryland, and most of Pennsylvania. Group III those of Ohio, Indiana, the lower peninsular of Michigan and Northwestern Pennsylvania. The cost and revenue per ton-mile are interesting, showing, as they do not only charge less per ton-mile here than in Germany, but the cost of transportation is about 15 per cent. less, notwithstanding the decidedly cheaper labor and lower interest charges in Germany, and the fact that our freight trains run considerably faster. It is true our average haul is longer and train load heavier, but after due consideration is given the effect of the longer haul and heavier train on reducing the cost of operation, the lower labor and interest charges in Germany far outweigh them, saying nothing about the speed. The American railroad managers can therefore fairly be said to have developed by far the most efficient system of freight transportation. That improvement is still going on is shown by the following table, giving for 1892 the same data as the above table for 1890:

	United States, 1892.		German Lines, 1891-92.
	Group II.	Group III.	
Length of line, miles..	18,668.	21,935.	26,207.
Freight ton miles per mile of line.....	1,492,056.	851,418.	693,674.
Average train load, net tons	234.24	220.74	185.6
Average distance each ton is hauled, miles..	109.7	123.8	62.67
Revenue per ton mile, cents.....	0.755	0.674	1.397
Cost per ton mile, cents	0.480	0.470	

The train crews on German roads are well disciplined, steady and careful. The engineers handle their engines with great care and skill in freight service, and trains rarely break in two, notwithstanding the very large amount of loose slack in each coupling, amounting commonly to as much as six inches betwen each two freight cars. In switching service cars are hauled with more care than is ordinarily seen in American practice. This, together with the much less weight and capacity of the cars themselves, makes damage from switching very light.

The comfort of the train crews both on the road and at terminals is well looked after. Many freight cars are fitted with shelter boxes, in which the brakemen are protected from severely inclement weather while at their post of duty.

The engineer and firemen on most roads are, however, compelled to stand continuously while on duty, no seats being provided. The engines are designed so as to be easily handled and cared for on the road, with all parts requiring attention readily accessible. At important terminals lodging rooms are usually provided for the crews resting away from home. The house in which such accommodations are provided are near or at the round houses. In some of these buildings hot and cold baths, as well as sitting and reading-rooms are provided.

Tests of Macallan's Variable Exhaust.

In the *Railroad Gazette*, pages 151 and 615, 1892, will be found a description of Macallan's variable exhaust. It consists of an exhaust nozzle hinged on one side to the exhaust pipe in such a manner that it can be swung out of action when desired. A lever and rod connection is made to the cab so that the engineer can change the opening of the exhaust pipe, or more correctly speaking, change the nozzle itself. The exhaust opening is always circular and conical just like the ordinary exhaust pipe and therefore cannot clog up or become inoperative. As used on the Great Eastern Railway in England, the larger diameter of opening is 5⅝ and the smaller 4¾ inches.

Some interesting tests have been made of the action of this nozzle on the Great Eastern Railway between Liverpool street and Chelmsford, and the diagrams and table with this give the results. The broken lines of the diagrams show the back pressure in the cylinders with the smaller opening, or nozzle, and the full lines the pressure with the larger opening. The front and back diagrams were taken simultaneously. Figs. 2 and 3 are drawn on a larger scale than Fig. 1, the ratio of the scales being 5 to 1. It is shown by these diagrams that with this class of engine there may be a considerable reduction in back pressure and a substantial saving in fuel from the use of the variable exhaust.

The object of a variable exhaust is well understood in this country and several different types are now in use with good results, but most of them have a defect which is common to nearly all devices having movable parts when used in a locomotive smoke-box. The heat is intense, and

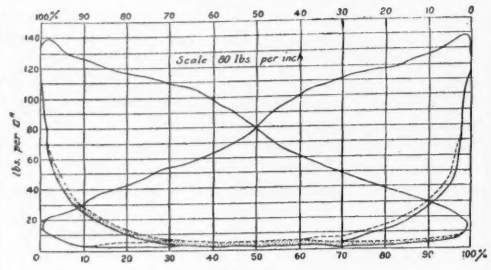


Fig. 1.

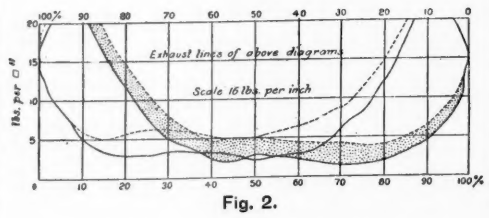


Fig. 2.

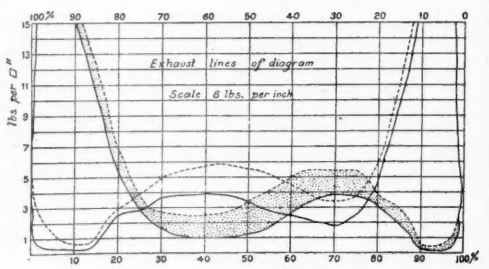


Fig. 3.

Showing the change in the back pressure line produced by a variable exhaust.

the water, oil, soot and cinders form a hard substance like a cement which clogs up the parts and makes them stick unless they are in constant service. It is sometimes of great advantage to be able to reduce the vacuum in the smoke-box by giving a larger opening to the exhaust pipe, so as to prevent the tearing up of the fires, especially during a heavy pull for a short distance. With anthracite coal there are times when it is very undesirable to have a heavy blast, and at other times a heavy blast is necessary, and to some extent this is true with soft coal, so it is generally acknowleged that a variable exhaust is a useful device that will increase the efficiency of a locomotive when it is properly and intelligently handled.

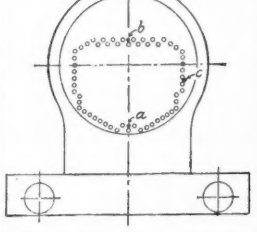


Fig. 4.—Location of points of vacuum measurement.

The Committee on Exhaust Pipes and Smoke-Boxes appointed by the Master Mechanics' Association, may be interested in the wide variation of results of the measurements of the vacuum in the smoke-box, given in the table, when the measurements are taken at different points in the box as shown by Fig. 4. The difference is as great as 40 per cent.

DATA FROM FIGURES 1, 2 AND 3—VARIABLE EXHAUST.

	Figs. 1 & 2.	Fig. 3.
Size of cylinders, inches.....	17½ × 24	17½ × 24
Diameter of drivers.....	68 in.	68 in.
Steam pressure.....	140 lbs.	140 lbs.
Revolutions per minute.....	162	84
Cut-off.....	35 per cent.	45 per cent.
Diameter of nozzle, inches.....	4¾ and 5½	4¾ and 5⅛
Mean effective pressure—small nozzle.....	68.4	.....
Mean effective pressure—large nozzle.....	72.1	.....
Average back pressure—small nozzle	11.9 lbs.	.....
Average back pressure—large nozzle	8.2 lbs.	.....
Increase in horse-power due to large nozzle.....	34	.....
Total horse power (about).....	748	.....
Vacuum in smoke box :		
At *a*, Fig. 4, with small nozzle.....	.....	2.8 in. of water
" " " large "	.....	2.3 "
At *b*, Fig. 4, with small nozzle.....	.....	2.6 "
" " " large "	.....	2.1 "
At *c*, Fig. 4, with small nozzle.....	.....	1.6 "
" " " large "	.....	1.3 "

Standard Caboose—C. C. C. & St. L. Railway.

The accompanying illustrations show the design and construction of a caboose of which a number have recently been built for the Cleveland, Cincinnati, Chicago & St. Louis Railway Company, under the direction of Mr. William Garstang, Superintendent of Motive Power, by the Terre Haute Car & Manufacturing Company, Terre Haute, Ind.

The under frame is of simple construction, the side, center, and intermediate sills, all of which at 4 by 8 ins. in section being framed to the end sills by double tenons, the end sills secured to side sills by one strap bolt at each end of the sill. These strap bolts are of ⅝ by 2 ins. flat iron with a ¾in. lip to enter the side sill and a ⅞ in. shank passing through the end sill. The strap is secured to the side sill by two ¾ in. bolts. The end sills are of oak 6 by 8 ins. in section, and all longitudinal sills of long-leaf, virgin Southern yellow pine. The sills are tied by two 4 by 10 in. needle beams gained ½ in. to receive the sills and secured to the sills by ⅝ in. bolt. Two 1⅛ in. truss rods are used. Malleable iron drawbars of the link and pin type are used on these cars. Between the needle bats are placed two tool boxes with double sliding doors.

The end and side plates are also from long-leaf, virgin Southern yellow pine, the end plates being 3 by 9½ ins. in section at the center, framed to the side plates with single tenons, and secured by a ½ by 2 in. strap bolt with a 1 in. lip entering the side of the end plate. A ⅝ in. counter-sunk bolt secures the strap to the end plate.

The car lines are of oak framed into the side plates with single tenons, the full width of the carline. The platform end carlines are 2½ by 3 ins. in section, the intermediate carlines 1¾ by 3 ins. in section and the center carlines 2⅝ by 3 ins. in section. The center carlines are provided with two 7-16 in. holes each, for receiving bolts which secure the upper deck to the carlines. All posts and braces are of oak and of the forms and sizes shown by the drawings. The bottom end plates of the lookout are of oak, 1¼ by 5⅛ ins. in section, cut to the radius of the roof, framed into the side plates, and bolted to the center carlines. The upper end plates are also of oak cut to the radius of the roof of the lookout and framed into the upper side plates. The end carlines of the lookout are framed into the side plates with door tail tenons, while the intermediate carlines are gained back on the under side and secured to the side plate with screws. Both upper and lower side plates are of yellow pine. The flooring is of yellow pine, 1¼ ins. thick, tongued and grooved and securely nailed to the sills at each bearing. The platform flooring is of oak, 1¼ ins. thick, tongued and grooved. The siding is of ⅞ in. double surfaced white pine, 6½ in. wide, tongued and grooved, beaded and center beded. The lining is of select, well-seasoned yellow pine, ⅞ in. thick, and 3 ins. wide, double surfaced, matched and beaded and laid horizontally.

The roof on the lower deck is of select white pine, ⅞ in. thick, and 5 ins. wide, nailed to the carlines side plates and end plates. This is covered with roofing tin, thoroughly painted on the under side before laying. A copper flashing is applied at the junction of the roof with the lookout. The roof is strengthened by four iron carlines ½ by 2½ ins. in section, extending across the car and bolted to carlines and to side plates. The lookout is roofed in the same general way and both roofs are covered with three coats of brown metallic paint. The outside of the car is painted red, the body inside receives one coat of shellac varnish and two coats of inside finishing varnish. The inside arrangement is quite clearly shown by the illustrations. Six cushioned seats are provided on the floor of the car and four short seats in the lookout. Below and between the seats are wardrobes, lockers, and cupboards for supplies of waste oil and coal.

The tail lamps are accessible from the inside of the car, a small window or opening being in the side of the car near the end through which the lamp projects. This window is shown in detail in figs. 7 and 8. Fig. 6 shows the method of securing the lookout of the side plate, and also the method of hanging the side windows of the lookout.

Foreign Railroad Notes.

Since 1880 the French railroads have been required to make elaborate reports half-yearly on the use of continuous brakes on their lines, intended to show the strong and weak points of the different kinds and hasten their improvement and general introduction. Now that such brakes are in general use and seem to need improvement only in details, a simpler form of report is to be called for hereafter, which is to be made only once a year. A similar simplification would be a good thing in England.

The Austrian Ministry of Commerce has issued a circular to all the railroad managements of the country regarding the complaints of insufficient provision for meals for passengers, of uncleanliness and bad ventilation of eating-rooms, the quality of the service and of the food and drink, and the like. The ministry demands that the railroads see to these things, keep sharp watch on the people who conduct the eating houses and buffets, and insist that they be properly kept. Placards must be posted on the walls and notices printed on the bills of fare that a book is kept for the entry of all complaints. And the government inspectors also are directed to keep a sharp eye on these establishments when they make their rounds. If the ministry could spare a few hundred inspectors to go through some of our American railroad eating houses with sharp sticks, the traveling public would be very much obliged.

The Russian Minister of Transportation has ordered that at junction points passengers arriving shall have the right to sleep in the waiting rooms of stations. The passenger is to apply to the chief of the station of the

road by which he arrives, who will give him a certificate that he arrived by his railroad, and this certificate entitles him to stay in the station. Practically it has never been otherwise, simply because at many junctions there is no other shelter; but the attendants at stations sometimes have made objections, and probably have extorted small coins from drowsy passengers waiting for a train in the morning.

Russian journals report that it has been decided to use petroleum as locomotive fuel on the Baltic Railroad, which is significant, because its lines are almost the most distant of any in Russia from the oil wells. Great reservoirs are to be built in St. Petersburg and Reval and three other stations, which will hold in the aggregate about 5,000,000 gallons. Coal should be cheap on this railroad, as English vessels come to the Baltic ports for grain, timber and other Russian produce, and will bring in coal at a nominal price rather than go in ballast.

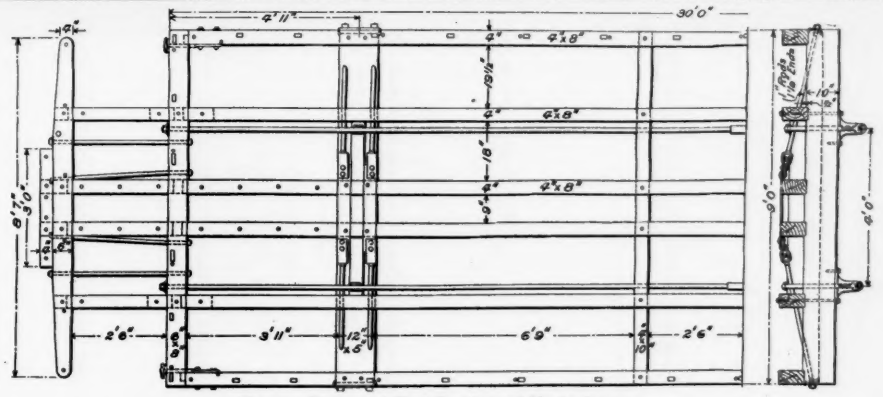


Fig. 1.—Plan and End Section of Underframe.

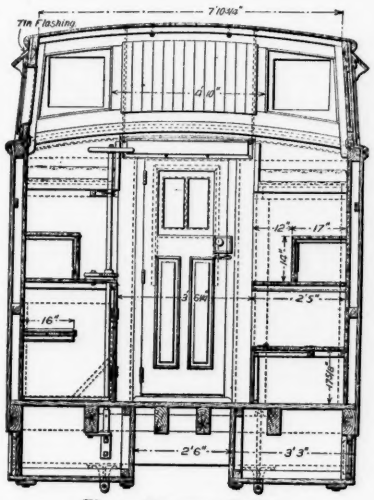


Fig. 4.—Transverse Section.

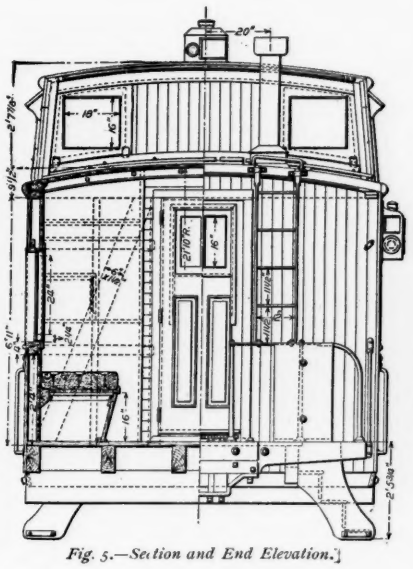


Fig. 5.—Section and End Elevation.

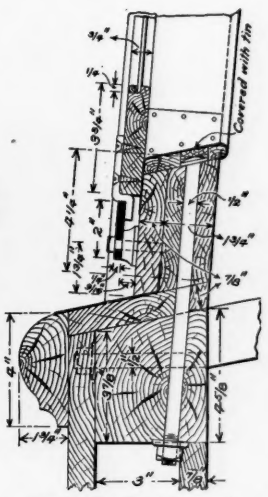


Fig. 6.—Details of Connection between Lookout and Roof.

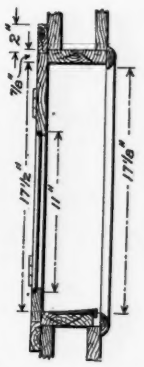


Fig. 7.—Vertical Section through Side Lamp Window.

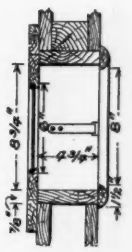


Fig. 8.—Horizontal Section through Side Lamp Window.

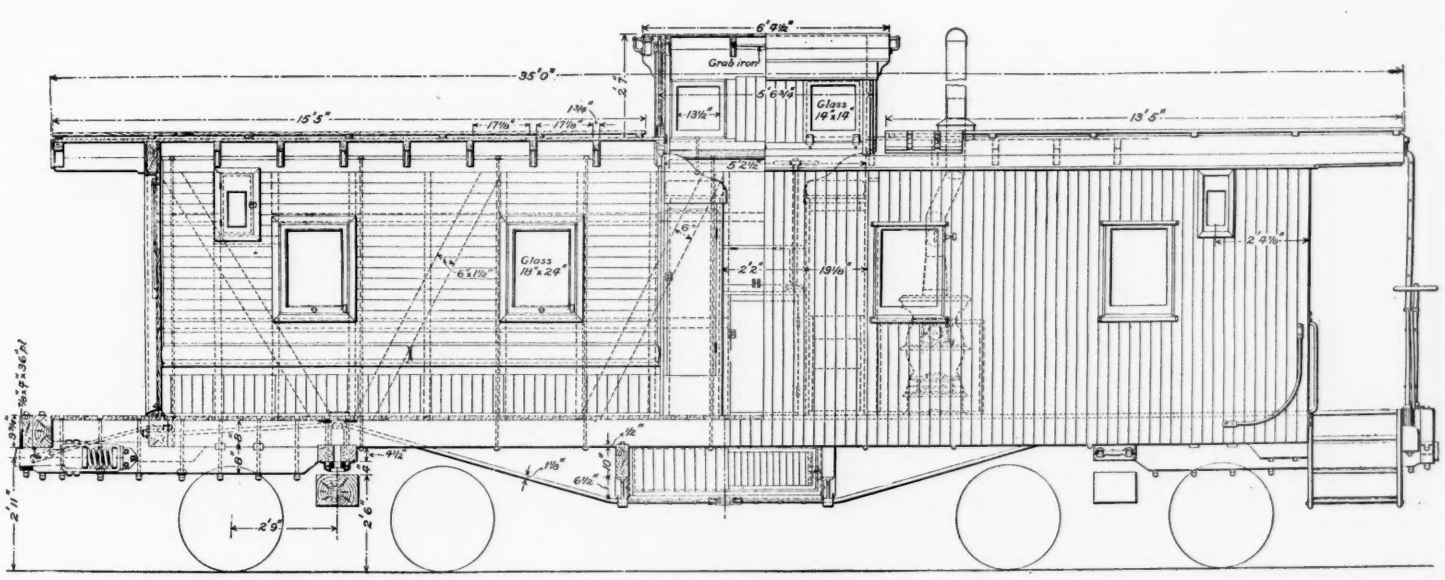


Fig. 2.—Side Elevation of Caboose.

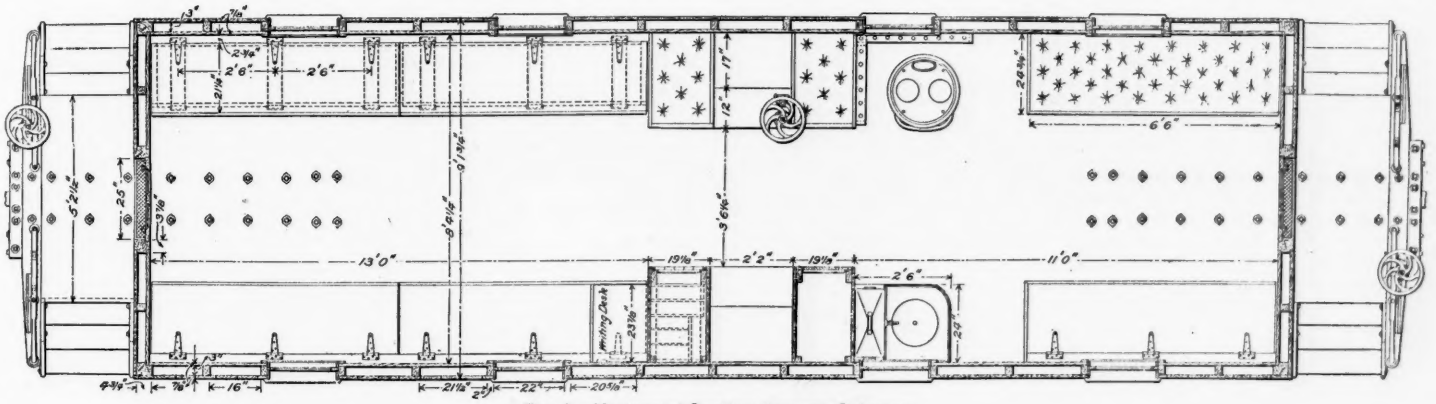
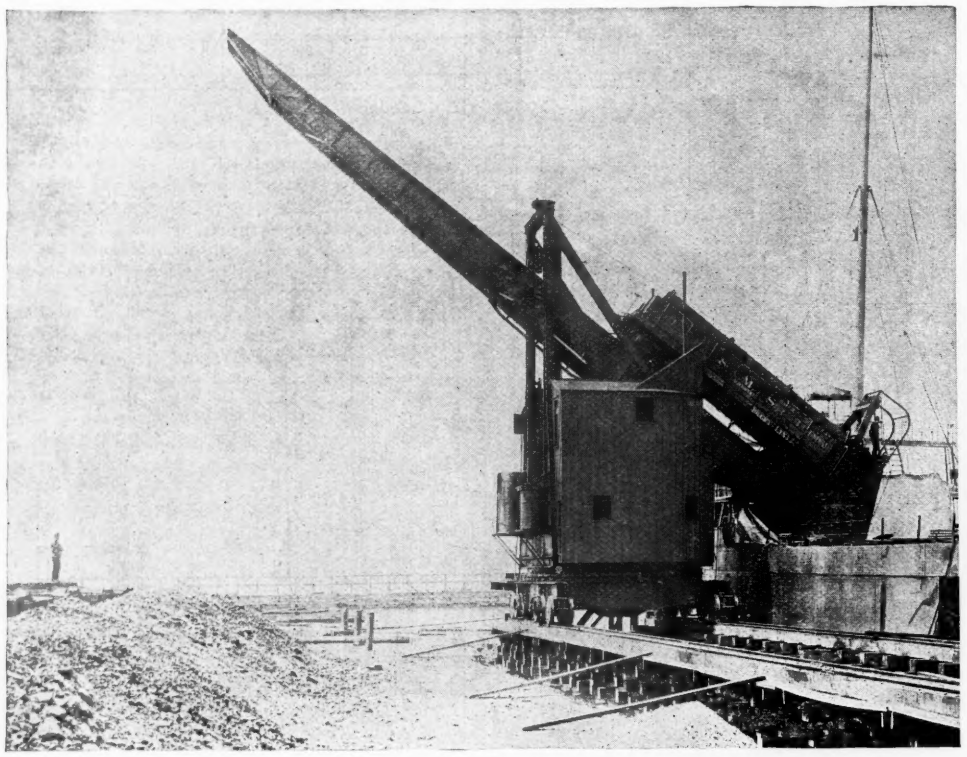


Fig. 3.—Horizontal Section through Caboose.

STANDARD CABOOSE CAR OF THE C. C. C. AND ST. L. RAILWAY.

The McMyler Coal Car Dumping Machine.

We illustrate a coal handling machine which has been designed to secure dispatch for vessels approaching that obtained in the ore trade, where ships of 3,000 to 3,500 tons are loaded in a few hours, and at the same time avoid loss in coal by overcoming the breakage. From an engineering standpoint it is novel, but it has had sufficient trial in actual service at Ashtabula, O., to demonstrate its practicability and to warrant the expectation that it will revolutionize the business of handling coal on the lakes. Patents on the machine are controlled by the McMyler Car Dumping Machine Co., of Cleveland, O., and the first was built by the McMyler Manufacturing Co. for Pickand Mather & Co., the Cleveland representatives of the Minnesota Iron Co.



The McMyler Coal Car Dumping Machine—Tilted to the Hatch.

This machine takes up a loaded car of about 23 tons capacity and dumps its contents into the hold of a vessel in a manner that avoids practically any fall of the coal, as the car is carried to the mouth of the hatch, and the load allowed to slide out in a mass through a chute. A car of 50 tons capacity could be handled in the same way and the efficiency of the machine greatly increased. Several records as high as 15 cars of 23 tons each (345 tons) unloaded in one hour have been made with the apparatus, and steamers ranging in capacity from 2,000 to 3,100 tons have been loaded in eight to twelve hours.

The machine is entirely self-contained and portable, having the turning features of a revolving derrick, with the addition of the girder or bridge. All trestle work is avoided; aside from the machine itself the only expense is that connected with the surface railroad tracks.

From a mechanical standpoint the machine may be described as a bridge of two plate girders turning on trunnions near the river or dock end of the bridge. These trunnions are carried on the framework of the house, which is in turn carried on about 100 12-inch wheels in a circle. The circular track on which these wheels move is supported through plate girder framework by 16 car wheels moving on four tracks, the outer ones of which are 24 feet apart. Back of the machine and its docks are six double lines of railroad track for loaded and unloaded cars, which are spaced about the same as hatches of vessels and perpendicular to the line of the dock. The power is furnished by a pair of engines which control the hydraulic power and all operating parts are controlled by friction clutches, requiring but one operator to handle the entire machine and only four men in all are engaged in working the plant. The other three are a fireman, a man employed on the bridge and a man to attach the cable to the draw-head of the car.

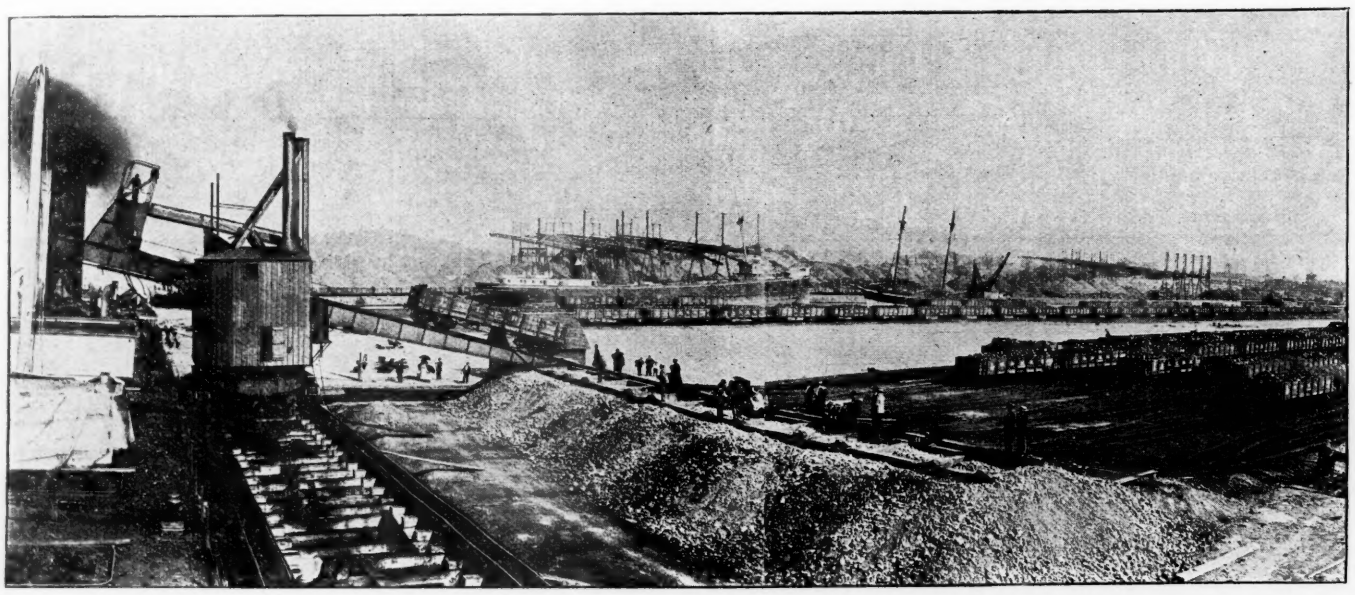
A hydraulic ram of 18¾ in. diameter, mounted on trunnions, tilts the bridge, which is so balanced that it rights itself, the ram forming an effective brake for it.

From an accumulator having at one end a hydraulic piston and at the other a steam piston 10 times the area of the hydraulic piston, is taken the pressure to operate the clutches for pumping, hoisting and driving laterally, and also the brake controlling the winding drum that pulls the car up the incline.

In operation, the vessels being placed so that the hatches are opposite the tracks, or nearly so, the machine is moved to the hatch which it is desired to load into; the steel cable, size 1¼ in. is hooked into the draw-head of the car and the car pulled up to the upper or shorter end of the bridge, which is so constructed as to form a bumper, against which the end of the car rests when tilted. The end board being withdrawn automatically through the tilting operation, the coal flows out through a discharging chute, and is concentrated in a telescopic trough or spout, which at the first flow of the coal may be lowered to within a few feet of the bottom of the vessel, when the work of loading begins at any of the several hatches, or to the surface of the coal itself after the bottom of the vessel is covered. In double decked vessels this chute may be lowered to the between deck combings. After the load is discharged the bridge is tilted back, the cable on the end board detached, the car allowed to run down and off the incline on to the track provided for "empties," a loaded car again taken up, and so the operation continues, the machine moving from one set of track to another and from one hatch to another as may be required. Thus the occasion for shifting a vessel while loading is very rare. Not only can the machine be moved laterally in either direction with a car on the bridge or platform, but it may be swung at the same time to avoid spars or any other obstructions on the vessel.

One feature of the machine is its adaptability to the kind of car in general use in the bituminous coal trade. The only change required is fitting sliding end boards in the cars. Immediately upon preparations being made for the erection of this first machine at Ashtabula, the management of the Lake Shore and the Pittsburgh & Lake Erie caused 1,000 cars to be fitted with sliding end boards and work has been started on 1,000 more of the same kind.

The capacity of the surface track plant shown in the large engraving, and from which cars are moved on to the platform of the machine by a locomotive constantly in attendance, is 140 cars or about 3,300 tons. Of course the number of sets of surface tracks for loaded and unloaded cars depends entirely upon the number of cars it is desired the plant shall handle, and as the entire transferring apparatus is arranged to move along a dock line, it can be made to accommodate any desired number of tracks and length of dock. From June 27 to August 22 this apparatus loaded 59,794 tons in 300 hours and 40 minutes. August 21 and 22 the following loadings were made: Steamer Manchester, 2,120 tons, 8 hrs. 30 min.; steamer Neshoto 1,854 tons, 7 hrs.; steamer Kearsarge, 3,724 tons, 13 hrs. 20 min.



The McMyler Coal Car Dumping Machine—Taking a Car.

The Board's Report on the New York and New Jersey Bridge.

The text of the report to the Secretary of War of the Board of Engineers appointed to examine into certain questions connected with the proposed bridge across the Hudson River was made public last Saturday. We give it below, nearly in full, but without the appendixes. The Board consisted of Mr. L. F. G. Bouscaren, Cincinnati; Prof. W. H. Burr, Columbia College; Mr. Theodore Cooper, New York; Mr. George S. Morrison, New York and Chicago, and Major C. W. Raymond, Corps of Engineers, U. S. A., all members American Society of Civil Engineers.

Your Board understand their duties to be to recommend what length of span, not less than 2,000 ft., would be safe and practicable for a railroad bridge to be constructed over the Hudson River between Fifty-ninth and Sixty-ninth streets in the city of New York. In making comparative estimates, your Board selected a location midway between Fifty-ninth and Sixtieth streets. . . . .

The minimum length of span which may be considered is 2,000 ft., which your Board has interpreted as meaning 2,000 ft. in the clear. The maximum length of span would be a clear span between the pier head lines, this distance varying from 3,130 ft. at Fifty-ninth street to 3,080 feet at Sixty-ninth street.

The objections which have been raised to a pier in the river apply with equal force to any pier located between the end of a 2,000 ft. span and the pier headline, the pier being objected to as interfering with the use of the river for harbor purposes rather than for through navigation. . . If the span is increased beyond 2,000 ft. any injury done to the harbor by obstructing the approach to piers on the New Jersey shore would be greater than any benefit gained by increased width of channel span. . . They have therefore confined their examination to a span of 2,000 ft. in the clear, as compared with a single span . .

A span of 3,100 feet in the clear would meet all the requirements of a single span.

The plans submitted by the bridge companies provide for a cantilever bridge carrying six railroad tracks. . . Your Board have thought it right to make estimates for a bridge furnishing this accommodation. . .

In the first place, your Board are of the unanimous opinion that a cantilever span 3,100 ft. in the clear could be built and would be a safe structure.

In the second place your Board has considered that the practicability of such a structure would depend upon its cost, and to determine this practicability has made comparative estimates of the cost of two cantilever bridges with clear spans of 2,000 ft. and 3,100 ft., respectively. These estimates are *comparative rather than absolute;* the benefit of doubt, where any exists, has been given to the longer span. The estimates include both substructure and superstructure, but have been made in round numbers and *do not include the cost of tracks and other features which would be coumon to both plans.*

A series of borings has been made by the bridge companies under the direction of Mr. C. B. Brush, C. E., at the request of your Board, to determine the character of the bottom of the river. These borings have found rock at varying depths, but as the borings were not extended into the rock, the absolute information before your Board is that no rock exists above the reported elevation rather than that solid rock exists below it; but your Board have considered themselves justified in assuming that it is a substantial rock, suitable for foundations.

The depth to rock is about 125 ft. at each pier-head line; it is about 260 ft. at the site where the pier of the 2,000-ft. span bridge would come; the rock rises rapidly from each pier-head line shoreward. The depth of water at the site of the river pier is about 50 ft. Under the water is a layer of mud or silt about 100 ft. deep. Below this mud is a fine sand, filled with fresh water under a pressure exceeding the head due to its depth. . . . . For the extraordinary weights and dimensions of the bridge authorized by the act, your Board is not satisfied that the piers would be safe unless founded on rock, and the comparative estimates have been made for rock foundations.

The lateral provisions to resist wind, and the longitudinal provisions for stability during erection, require a considerable base. The plans submitted by the bridge companies proposed to use a pier consisting of four cylinders placed 200 ft. between centres in each direction. The total erection, including the effects of wind pressure carried on each cylinder is estimated at 25,000 tons.

In proportioning these piers your Board has found it necessary to adopt limits of stress. They have based their estimates on the supposition that the pressure between the metallic bed plates and the top of the masonry should not exceed 20 tons to the square foot, and that the pressure within the masonry and on the foundation should nowhere exceed 10 tons to the square foot. They consider, however, that in determining these pressures the weight of the material displaced should be deducted. The weight of masonry per cubic foot was taken at 150 lbs. in air, at 87 lbs. in water, and 50 lbs. in mud, and at 30 lbs. in sand. While these pressures have been exceeded in some structures, they are higher than usual practice, and call for masonry of good quality and more than ordinary cost.

Your Board have assumed that the masonry would finish 50 ft. above water, and have estimated the cost of the piers, including excavation and sinking, at $1 per cubic foot above a plane 125 ft. below water, and have added 8 mills to this for each additional foot of depth.

2,000 FEET CLEAR SPAN CANTILEVER.

The east pier of the bridge, with a clear span of 2,000 ft., would be immediately back of the New York pier-head line, where the rock is 125 ft. below mean high water. The west pier would come in the river, where the rock is 260 ft. below mean high water. The east anchorage would be within the shore line, where the rock is not more than 20 ft. below mean high water, and the west anchorage would be immediately west of the New Jersey pier-head line, where the rock is 125 feet below mean high water. The site of the west anchorage calls for an anchorage span 100 feet longer than shown on the plan of the bridge companies.

The east pier would consist of four cylinders, each containing 866,000 cubic feet, and costing on the basis given above, $866,000, making for the four cylinders $3,464,000.

At the site of the west pier [river] the average depth of rock is not less than 260 feet. A foundation carried to rock here would be nearly 100 feet deeper than any foundation which has ever been put in. Such a foundation involves very careful consideration, and your Board believes that the additional price allowed for so much of the work as is more than 125 feet below water is none too large. Each of the four cylinders would contain 1,880,000 cubic feet, of which 1,014,000 would be more than 125 feet below water, making the cost of each cylinder $2,427,500 and the cost of the four cylinders $9,710,000.

The east anchorage pier would be founded on the rock about 20 feet below mean high water, and the west pier on rock 125 feet below water. Each of these piers should be estimated on the basis of a pier finishing 150 feet above high water, 20 feet thick, and 100 feet long on top, built with a batter of 1 in 20, and founded on a caisson 40 by 120 feet for the east pier, and 45 by 125 feet for the west pier. Taking the cost of the work above water at 75 cents per cubic foot, and of the work below water at $1, the cost of the east pier becomes $431,000, and that of the west pier $1,038,000. The cost of the substructure for the bridge with the 2,000 foot span would be.

East anchorage	$431,000
East pier	3,464,000
West pier	9,710.000
West anchorage	1,038,600
Total	$14,431,000

A careful estimate prepared by the bridge companies makes the weight of the superstructure 230,000,000 pounds, including the main span, the towers, and the two anchorage spans, covering a total length of 4,120 feet. This weight has been checked and may be taken as approximately correct. The plan was prepared for a location at Seventy-second street, where the distance between pier-head lines is 3,070 feet. At Fifty-ninth street the west anchorage span would be lengthened 100 feet, and if the bridge is kept symmetrical the whole length will be increased to 4,320 feet and the total weight to about 240,000,000 pounds. This estimate is based on a moving load of 3,000 pounds per foot of track and on maximum working stresses of from 20,000 to 22,500 pounds per square inch, or about one-third of the ultimate strength of the material; 240,000,000 pounds, at 4½ cents per pound, would cost $10,800,000. The cost of this bridge would then be $25,443,000.

This is the cost of a cantilever bridge of the minimum span which your Board is authorized to consider, the length of the entire structure from anchorage to anchorage being 4,320 feet. As this plan of bridge is the one which the New York and New Jersey bridge companies have selected as the bridge they wish to build, its cost must be accepted for present purposes as the cost of a practical structure.

3,100 FEET CLEAR SPAN CANTILEVER.

The site of the east pier for the span of 3,100 ft. would be the same as that for the 2,000-foot span; the site of the west pier would be the same as that of the west anchorage for the 2,000-foot span. Both piers would be founded at practically the same depth, or 125 ft. below mean high water. The weight of the trusses of the long span would be about three times the weight of those of the short span, and the weight of the floor and moving load would be about one and a half times that of the short span. The total reaction on the piers would be at least two and one-half times that of the short span. On this supposition each of the four cylinders would have to carry 62,500 tons.

The piers in both bridges are so large that their volume can be proportioned directly to the weights they have to carry. This would make the volume of each pier of the 3,100 foot span bridge two and a half times that of the east pier of the 2,000 foot span bridge. The estimated cost of the east pier of the 2,000 foot span bridge was $3,464,000, so that we may estimate the cost of each of the two piers of the 3,100 foot span bridge at $8,660,000.

The anchorage piers required for the long span bridge need be little larger above the water level than for the shorter span. The anchorage pier on the east side would be on rock about 20 ft. below mean high water; its cost would be about the same as that for the 2,000 foot span. The anchorage pier on the west side would be on rock 40 ft. below mean high water and is estimated to cost $527,000. The total cost of the substructure for the 3,100 ft. clear span bridge would then be:

East anchorage	$431,000
East pier	8,660,000
West pier	8,660,000
West anchorage	527.000
Total	$18,278.000

Estimates by this Board show that the weight of the superstructure of this bridge would be approximately 730,000,000 pounds, about three times that of the shorter span bridge. This, at 4½ cents per pound, is $32,850,000.

The total cost of the 3,100 foot span bridge, covering a length of 6,100 ft. from anchorage to anchorage, may therefore be estimated at $51,128,000, though this estimate is probably too low.

The estimated cost of the 2,000-foot span bridge was $25,443,000 for 4,320 ft. To bring it into proper comparison with the longer span bridge, 1,780 ft. of viaduct must be added. Estimating this viaduct at $1,000 a foot, the cost becomes $27,223,000. The estimated cost of the long span cantilever bridge is $23,905,000 more than this amount. Your Board is of the opinion that the additional cost of the long span cantilever bridge is so great that it must be considered impracticable.

SUSPENSION BRIDGE.

A suspension bridge is another possible form of construction at this location. Like the cantilever, it can be erected without false work; unlike the cantilever it has not generally been considered well adapted to railroad uses. It has less rigidity than the cantilever, and deflects more from the combined effect of temperature and load. The flexibility of the cables tends to cause vertical undulations of the platform under a moving load, which are more objectionable for a railroad bridge than for a highway bridge, where the live load is less concentrated and is applied less rapidly. These objections lessen in importance as the span of the bridge and the proporton of the dead to the live load increase.

In a bridge with six independent tracks, the condition of railroad service approaches that of highway service, and the position of trains which will produce a maximum disturbance would be of very rare occurrence. The inclination of the platform longitudinally and transversely, arising from the undulations of the cables under the effect of moving trains, can be reduced within unobjectionable limits by a proper system of stiffening; the effect of wind on cables and platform can be taken care of by cradling the cables and by a lateral system of bracing in the platform similar to that used in truss bridges. A single railroad track suspension bridge of 850 ft. span has been in continuous use, under restrictions of load and speed, for nearly 40 years at Niagara. With this example before us, a six-track railroad suspension bridge of 3,100 ft. clear span cannot be dismissed without careful consideration.

Your Board have therefore investigated such suspension bridge with great care, and it is its opinion that it could be built and that it would be a safe structure. As this opinion may be thought a departure from general opinion as to the adaptability of the suspension bridge to railroad service, it is proper that the Board should state their reasons therefor, and explain the features of the plan adopted by them for a comparative estimate in more details than was done for the cantilever plans.

The essential differences between a cantilever and a suspension bridge are: First, that in the place of compression chords of the cantilever we have land anchorages built of eye bars and masonry; second, in place of the tension chords of the cantilever we have cables built of wire of a superior grade of metal; third, in place of the web bracing of the cantilever we have a composite system of suspenders and stiffeners.

No question can be raised as to the safe and permanent character of the anchorages if built with a sufficient factor of resistance and proper provisions for thorough protection of the anchor chains against rusting. They have the advantage over the compression chords of the cantilever, that their weight is supported directly on the ground instead of forming a part of the dead load to be carried.

As regards safety and efficiency, the wire cables are fully equal to the eye bar chords, if built with the same margin of strength. Experience shows that they can be effectively protected against rusting by wire wrapping and painting. Wire at least three times as strong as eye bar steel is a merchantable article, and cables made of this wire have the advantage over eye bar chords of less weight to be carried by the superstructure.

The objections made to suspension bridges arise only from the third difference. It is often claimed that a sufficient degree of rigidity cannot be secured for railroad purposes, and that the stiffening members cannot be properly proportioned, owing to the uncertainty which exists in the intensity of stress due to changes of temperature and elastic deformation in the composite system. The Board has given careful consideration to these objections and believes that for practical purposes they are met in the plan selected.

Three principal methods have been employed to secure greater rigidity in suspension bridges: First, by inclined stays extending from the top of the towers to the platform. This system was advocated and applied extensively by the late John A. Roebling. Second, by trussing the cables either with straight chords, as in the Point Bridge at Pittsburgh, or by a system of braces between two cables, as proposed by Mr. G. Lindenthal for his projected North River bridge. Third, by a stiffening girder fastened to the platform and extending from one tower to the other. This system is a feature common to nearly all suspension bridges, but has seldom been applied in the most approved form to give the best results. The first method is at best incomplete, as a stiffening truss must be used for the middle half of the span. The second method might prove the most economical, but its application to wire cables is still untried. Your Board has therefore selected the third method, that of the stiffening truss.

The suspension bridge which your Board has selected for this location would consist of a single span of 3,200 ft. between saddles, thus giving about 3,100 ft. in the clear, the two towers being located at the pier-head lines and the cables being carried in straight lines from the top of the towers to the anchorages, making equal angles on each side of the towers. This form of bridge has no side spans, but the tracks would be carried on viaducts between the towers and the anchorages. While the use of cables outside the towers to sustain side spans is generally considered economical, the arrangement selected gives the least length of cable and reduces deflection from strains and temperature to a minimum.

The two towers would be located in practically the same position as the towers of the 3,100-foot cantilever. The substructure would be of masonry, finishing at the same height as the masonry of the cantilever bridge piers. The towers themselves would be of steel, and would be 570 ft. high from top of masonry to saddles, or 620 ft. from surface of water. For towers of this height there is no question of the economy and expediency of using metallic construction. The anchorages would be of masonry, each located about 1,000 ft. back of the towers. Both towers and anchorages would have to be founded on rock.

The cables would be of wire, and the plans have been based on cable containing about 6,000 No. 3 wires (0.259 inches in diameter). Wire makers are prepared to furnish a wire of this size, of the guarranteed strength of 180,000 pounds per square inch, at moderate prices, and a much stronger wire at a higher price. Your Board has adopted as the unit stress on cables made of straight wire of this character 60,000 pounds per square inch or one-third of the breaking stress, this being the same proportion of the ultimate strength that the 20,000 pounds adopted in the cantilever structure bears to the probable strength of eye bar steel.

Your Board has estimated on a versed sine of 400 ft. or one-eighth of the span. In the East River bridge the versed sine is less than one-twelfth of the span and about the same as in other long span suspension bridges. In the East River bridge the cables are of steel wire and the towers of masonry. With the introduction of steel towers the ecomomical proportions are changed and it becomes practicable to adopt a greater versed sine than has hitherto been considered wise.

Stiffening Truss.—There are several admissible forms of stiffening truss. To justify the particular form selected by the Board for its estimate it is proper to give a short explanation of its duties and mode of action.

A stiffening truss is a girder supported by the cable and extending from one tower to the other. It is fastened to the platform at the several points of suspension to the cables, and it may be fastened to the towers in two ways; it may be held in the vertical direction, anchored down as well as supported, and acting as a girder resting on two supports, or it may be fastened also in the horizontal direction, acting as a girder fixed at the ends. The Board has confined itself to the first case, which has the advantage of greater simplicity in computation of stresses without material sacrifice of economy.

The function of a stiffening girder is to distribute a load covering only a part of the span over the entire span. If this function could be performed without any deformation of the girder, the distribution would be perfect, and the symmetrical shape of the cables would be preserved, but as the girder deflects under the load that it carries, it exerts, through the suspenders, a downward pull on the cables as far as the load extends, and beyond that point the cable exerts a pull upward on the girdle. If it is continuous it will take the shape of a reverse curve, with its point of contra-flexure at the end of the load. The strain in all the suspenders will be uniform for the whole length of span. The weight to be carried by the loaded portion of the stiffening truss will be the moving load upon it less that carried by the suspenders. The suspenders over the unloaded portion, where the cable tends to rise, are strained by the resistance of the stiffening truss against flexure upward. The weight per unit of length carried by the suspenders will always be equal to the live weight per unit multiplied by the length of load and divided by the length of span.. Over the loaded portion this is the actual weight per unit of length, less the portion carried by the stiffening truss. Over the unloaded portion this represents the upward pull resisted by the stiffening truss. The upward force per unit of length which tends to lift the unloaded portion is therefore the assumed weight per unit multiplied by the length of load and divided by the length of span. The weight per unit of length carried by the stiffening truss on the loaded portion is the total weight per unit of length, less that weight multiplied by length of load and divided by length of span.

When one-half of the span is loaded the weight will be equally divided between suspenders and stiffening truss; the stresses in the chords of the stiffening truss will be one-eighth those caused by the same load extending over the whole length of the span if the truss were not supported by suspenders.

The greatest stresses occur in the continuous stiffening truss when either two-thirds or one-third of the span is loaded. In the former case the loaded portion must carry one-third of the load, and the chord stresses at the middle of that two-thirds will be $\frac{4}{27}$ of the maximum stresses at the center of the span if the truss were fully loaded and not supported by suspenders; in the latter case the chord stresses at the center of the loaded portion will be only $\frac{2}{27}$, while the chord stresses at the center of the unloaded portion will be the $\frac{4}{27}$, but reversed. As the two-thirds load may be placed anywhere in the truss, it follows that the chord stresses over the whole central third may be $\frac{2}{27}$ of the maximum stress at center of span, if the truss were fully loaded and not supported by suspenders. The shearing stresses in the webs of the stiffening truss are determined by the same distribution of loads.

It must be remembered that the only stresses in the stiffening truss are those due to moving load, all dead weight being carried directly by the suspenders to the cables.

While this is the simplest explanation of the duties of the stiffening truss, it does not take into consideration all elements. The downward and upward deflection of the stiffening truss must be accompanied by corresponding changes in the shapes of the cables, but as these changes are in the direction in which the cables would move if no stiffening truss existed, it follows that the

weight is not distributed equally among all the suspenders, and the stiffening trusses relieved of resisting so much inequalty as is taken by the cables. The elongation of the suspenders is also a slight element of disturbance, but not sufficient to be described here. An analysis of it will be found in Appendix A.

There are two other strains which the chords of the stiffening truss may be called upon to resist. The first of these is due to the deflection of the cables under temperature and under load. As the stiffening truss is not supposed to carry any of its own weight, it must deflect with the deflection of the cables, and this deflection must be accompanied by the transfer of a portion of its own weight to itself with corresponding stresses in its chords, these chord strains being determined entirely by their deflection. The other additional stress is due to wind pressure if the chords of the stiffening truss are made the chords of the lateral system as in ordinary truss bridges.

The greater the depth of the truss the less the chord stresses due to its stiffening duty, and the greater the stresses due to deflection of cables. The wind stresses depend on the horizontal distance between the two trusses.

To avoid the strains due to deflection of cables the stiffening truss may be hinged at the centre, which can be done by cutting one chord and putting a pin joint in the other. This arrangement fixes the point of contrary flexure at the centre of the span under all conditions of loading, and leaves the stiffening truss free to rise and fall with changes of deflection in the cables without additional strain. As the bending stresses at the centre are now eliminated, the only function of the pin joint will be to transfer the shearing stresses. With the introduction of the hinge and the fixing of the point of contrary flexure, the work of the stiffening truss is modified and the investigation becomes more complicated; it is given in Appendix A. The truss still equalizes the weight on all the suspenders, but the total weight carried by the suspenders is equal to the whole moving load only when that load covers one-half the span. The greater chord stresses in either direction occur at a distance equal to 0.234 of the span from each end, and will be 0.1506 of the maximum stresses at centre of a continuous span if the truss were fully loaded and not supported by suspenders.

The maximum chord stress in the hinged truss is therefore 1.017 times that in the continuous truss, but it is a maximum only at two points instead of over one-third the span.

The continuous truss is better adapted to resist wind than the hinged truss, but its chords have to bear additional stress due to deflection. As the hinged truss is practicable and more economical than the other it has been used in the estimates made by your Board.

The form which your Board has selected for a stiffening truss is a riveted lattice girder 120 ft. deep, the two trusses being placed 100 ft. between centres. The web members are all inclined at an angle of 45 degrees, and are in eight systems, so that the truss is divided into 30-foot panels, and the unsupported length of each web member is about 21 ft. The floor beams are hung from the suspenders and carry the stiffening truss, the weight of which is never entirely overcome by the action of the moving load. The top lateral system is a comparatively light riveted lattice. The whole lateral work to resist wind pressure is done by the bottom lateral system, in which the floor beams form lateral struts and the diagonals are strained in tension. Cross bracing is provided at every panel point to sustain the floor beams at their centres and to transfer wind pressure to the bottom chord, the pull of this cross bracing being resisted by the top lateral system.

Proportioning the trusses for a moving load of 3,000 lbs. per foot on each of the side tracks, the maximum chord stress at the centre of the half span would be 14,461,400 lbs., and the maximum chord stress in the bottom chord at the centre, taken on the basis of a wind pressure of 2,000 lbs. per lineal foot, would be 25,600,000 lbs. As the chords are subject to reversal of strains, your Board have limited the stresses in the chords due to moving load to 12,500 lbs. per square inch in each direction, making an extreme variation of 25,000 lbs., but have allowed the stresses from the combined effects of moving load and wind to run up to 22,500 lbs., believing that with the arrangement of cradled cables hereinafter described the wind strains will never be anything like what has been estimated on. They have also estimated on the chord sections never being less than 400 square inches. With these conditions the average section of the bottom chord becomes 996 square inches, and that of the top chord 905 square inches, the two averaging 950 square inches. Allowing 25 per cent. excess for details, the average weight of each chord will be 4,037.5 lbs. per lineal foot.

The average shear in the web system will be 3,000,000 lbs., in addition to which the web system has to do a duty in transferring weight from the upper to the lower chord equivalent to a shear of 1,300,000 lbs. per lineal foot, making the total duty of each web equivalent to an average shear of 4,300,000 lbs.

If the web is proportioned on the basis of 12,500 lbs. per square inch, with an allowance of 50 per cent. for details and connections, the weight of each web becomes 3,509 pounds per lineal foot.

The calculated weight of the top laterals is 500 lbs. per lineal foot. The calculated weight of the bottom laterals, on the basis of 25,000 lbs. stress per square inch, with an allowance of 25 per cent. for details, is 1,150 lbs. per lineal foot, making total weight of laterals 1,650 lbs. per lineal foot.

The floor beams weigh 90,000 lbs. each, or 3,000 lbs. per lineal foot of bridge. The stringers weigh 1,800 lbs. per lineal foot of bridge. Floor beams and stringers are proportioned for a consolidation locomotive, weighing with tender, 104 tons. The total weight of the suspended superstructure per lineal foot may then be taken as follows:

Four chords, at 4,037.5 pounds	16,150 pounds
Two webs, at 3,509 pounds	7,018 pounds
Laterals	1,650 pounds
Cross frames and hangers	1,920 pounds
Floor beams	3,000 pounds
Stringers	1,800 pounds
Total steel per lineal foot	31,538 pounds

This amounts to 100,921,600 lbs. for the 3,200 ft. of span. If to this we add 2,400 lbs. for the weight of the ties and rails and 18,000 lbs. for moving load, we have as the total weight carried by the suspenders 51,938 lbs., or 26 tons per lineal foot.

This stiffening truss is a very different structure from the stiffening truss of any existing bridge. It is what it purports to be, a stiffening truss, with a heavy floor system like that used in the cantilever design, and with stiff connections throughout. This stiffening truss, 3,200 ft. long, with its floor system, weighs two-fifths as much as the entire 4,320 ft. of steel work of the 2,000 foot cantilever bridge.

Suspenders.—The suspenders would be either wire ropes or cables of straight wires like the main cable. They have been proportioned on the basis of a stress of 30,000 lbs. per square inch of section, and on this basis, with an allowance of 20 per cent. for connections, will weigh 1,425 lbs. per lineal foot, making the whole weight transferred to the cables 53,363 lbs The suspenders weigh 4,560,000 lbs. for the 3,200 ft.

Cables.—The average weight of the cables will be 14,792 lbs. per lineal foot of bridge. The total weight to be carried by the cables may therefore be taken at 68,100 lbs. per lineal foot, amounting to 217,920,000 lbs., or 109,000 tons for the span of 3,200 ft. The versed sine assumed is 400 ft., or one-eighth of the span. The greatest strain in the cables will be next to the saddles, and will be equal to the weight carried muliplied by 1.118, amounting to 243,724,000 lbs., which, at 60,000 lbs. per square inch, will require 4,062 square inches. Six thousand No. 3 wires have a total area of 316 square inches. The 4,062 square inches may be divided into twelve cables of 338.5 inches each. Your Board believes that these cables can be constructed now as easily as those of the East River Bridge were at the time it was built.

The arrangement of cables which has seemed most feasible to your Board, and which has been used for the basis of these estimates, places six cables on each side, the cables being 20 ft. apart on top of towers, the two cables next to the centre on each side being in vertical planes, and the other cables cradled into planes which intersect in the lines of the pins which sustain the floor beams. A separate suspender reaches from each pin to every cable, the suspenders being in the same planes as the cables.

Vertically the cradling of the outside cables is 100 ft. in a height of 460 ft., or one in 4.6. Horizontally it is 100 ft. in a total length of 3,200 ft., so that the horizontal cradling of the two outside cables is 200 ft. in 3,200 ft., or one in 16. A sufficient cradling is obtained not only to resist the entire wind pressure on the cables, but to relieve the lateral system very materially. The distance between the cables will favor simultaneous construction. The suspenders at each point will be of uniform length and will pull together. The length of the suspenders at the centre of the span must be enough to allow the cables to clear each other where the attachment is made, and this places the lowest parts of the cables 60 ft. above the pins. The total height of the towers above high water is made up as follows:

	Feet.
Clearance required by law	150
Camber	10
Shortest suspender	60
Versed sine	400
Total	620

The total length of each cable from anchorage to anchorage is 5,609 ft. The weight of each of the twelve cables per lineal foot of cable, including wrapping, is 1,183 lbs. The weight of the twelve cables is 14,200 lbs per lineal foot and the total weight of the cables 79,647,800 lbs.

Towers.—The weight transferred by the cables to each tower is 218,000,000 lbs. The towers are 570 ft. high from top of masonry to saddles As these towers are only in compression and the members so large that they may be treated as short compression members, a stress of 20,000 lbs per square inch at the top is permissible This requires 10,900 square inches of section. The weight of each tower, with an allowance of 80 per cent. for details and connections would be 38,023,560 lbs., or 76,047,000 lbs. for both towers. The total weight to be carried on the lower part of the tower would be 128,000 tons, making a pressure of less than 24,000 lbs. per square inch at the base of the steel columns, which will be very slightly increased by the wind pressure and by the horizontal deflections at the top of the towers if the saddles do not move freely.

Anchor Chains.—The cables are carried in straight lines from the saddles to the anchorages, each anchorage being in two parts, each part anchoring the six cables on its side of the bridge. The upward pull of the cables at each anchorage (one side) is 54,500,000 lbs., and the horizontal pull 109,000,000 lbs. The estimates have been made on the basis of connecting the cables with the anchor bars outside of the masonry of the anchorage, placing these anchor bars in tunnels, and connecting them with bearing plates at the lower ends. Everything would be accessible for care and repairs. The chains would be of steel eye bars, which have been proportioned for a stress of 20,000 lbs. per square inch, with an allowance of 20 per cent. for details. The estimated weight of the bars and pins in each of the four half anchorages is 6,825,000 lbs., while the plates at the bottom would add 600,000 lbs. to this amount, making the total weight in each half anchorage 7,425,000 lbs., or 29,700,000 pounds in the four.

Structural Steel.—In estimating the cost of the structural steel work your Board used the same price per pound as for the work in the cantilever bridge, namely 4½ cents. On this basis the cost would be as follows:

Suspended superstructure	100,921,600 pounds
Towers	76,047,000 pounds
Chains	27,300,000 pounds
Anchor plates	2,400,000 pounds
Structural steel	206,668,600 pounds
At 4½ cents	$9,300,087

The majority of the Board believes that this price is too high, owing to the difference in character of steel work in the two structures, and that the total cost of the structural steel work should not be estimated higher than $8,500,000.

Wire Work.—The cables and suspenders have been estimated at 8 cents per pound, making their cost:

Cables	pounds	79,647,800
Suspenders	"	4,560,000
Total wire	pounds	84,207,800
At 8 cents		$6,736,624

Superstructure.—The total cost of the superstructure is $16,036,711, on the basis of 4½ cents for all structural steel.

Substructure.—The substructure would consist of two anchorages and the bases for two towers. Each tower base has to carry the following weights:

Suspended weight on top of tower	109,000 tons
Tower	19,000 tons
Extra effect of wind	4,000 tons
Total	132,000 tons

Each of the tower bases of the 2,000 ft. cantilever bridge carries 100 tons. In both cases the foundations can be made proportional to the weight carried. The east tower is in the same place as in the east pier of the cantilever bridge. The cost of this base for the suspension bridge tower will be that of the cantilever bridge pier, or $3,464,000, multiplied by 1.32, making $4,572,480.

The west tower would come immediately west of the New Jersey pier-head line, the average depth of rock being about ten feet more than on the east side, requiring 414,000 cubic feet additional in the foundation. Estimating on the same basis as for the west pier of the cantilever bridge, the cost of this 414,000 cubic feet of foundation would be $431,000, which would make the cost of the west tower base $5,003,480.

The anchorages have been planned on the basis of putting the entire weight which is to resist the pull of the cable above mean high water, and the quantities have been based on a co-efficient of friction of 0.6 and a factor of safety of two. The anchorage at each end of the bridge would contain 5,940,000 cubic feet above the foundation. The only duty of the anchorage is to act as weight, and a very cheap class of masonry can be used for this purpose; rubble made of the most available stone, with a facing of rough ashlar or brick, would do. The cost of this masonry has been estimated as 37½ cents per cubic foot, although the Board believes it could be built for much less. On this basis the cost of each anchorage above the mean high water is $2,227,500.

The east anchorage would be founded where the rock is twenty feet below mean high water; the foundation could be put in with a coffer dam and has been estimated as costing 75 cents per cubic foot. There would be 1,150,000 cubic feet in this foundation, making the cost $862,500, and the total cost of the east anchorage $3,090,000.

The foundation of the west anchorage would have to be sunk sixty feet to reach the rock, and would probably be put in by the pneumatic process. Its volume would be three times that of the east anchorage, and its cost may be estimated at the same price per cubic foot, or $2,587,500, making the total cost of the west anchorage $4,815,000.

The total cost of the substructure would then be:

East anchorage	$3,090,000
Base for east tower	4,572,480
" west "	5,003,480
West anchorage	4,815,000
Substructure total	$17,480,960

The anchorages can be adapted to carry the tracks, but the tracks must be carried between them and the towers on viaducts, requiring 925 ft. of viaduct on each side, or 1,850 ft. in all, which has been estimated at the same price as before. The total length of the suspension bridge, including viaducts and anchorages, is 5,600 ft. The total cost will be as follows:

Superstructure	$16,036,711
Substructure	17,480,960
	33,517,671
Viaduct	1,850,000
Total	$35,367,671

The estimated cost of the 2,000-foot cantilever bridge was $25,443,000 for 4,320 ft. To compare it with the 5,600-foot suspension bridge, 1,280 ft. of viaduct must be added. This makes the cost $26,723,000. The estimated cost of the suspension bridge is $8,644,671 more. The fairest comparison is by percentages; the cost of the suspension bridge is nearly 32½ per cent. more than that of the 2,000-foot cantilever bridge. If allowance is made for cost of structural steel in accordance with the views of a majority of the Board, the difference will be reduced to $7,844,584, or nearly 30 per cent. The general conclusion which your Board has reached is that the cost of a suspension bridge of a single span, designed for its whole length for the same moving load as the 2,000-foot cantilever bridge, would be less than one-third more than that of the cantilever.

Deflections.—The structure described is one of unusual rigidity. The expansion of the metallic towers counteracts in a degree deflections due to elongations of cables under an increase of temperature, this deflection being further reduced by the large versed sine. Of the thirty-four tons per lineal foot, only nine are moving load, so that the stress per square inch on cables caused by a maximum moving load is less than 16,000 pounds; it would not exceed 5,000 pounds with an ordinary freight train on every track, or 2,500 pounds with a passenger train on every track. The deflections have been calculated for a full moving load with the following results:

Conditions.	Effects of				
	Cable between Towers.	Back Stays.	Towers.	Suspenders	Total.
60° ± F.	∓ 2	∓ 0.1	± 0.22	∓ 0.03	∓ 1.91
Max. Mov. load	— 2.75	— 0.14	— 0.11	— 0.02	— 3.02
Combined	— 4.75	— 0.24	+ 0.11	— 0.05	— 4.93

In other words, the total deflection at the center of the span below a mean is about five feet; the deflection above a mean is less than two feet; the total range is less than seven. These deflections are within satisfactory limits for railroad service.

A deflection of five feet in a length of 3,200 ft, calculated for a modulus of elasticity of 28,000,000 pounds, corresponds to a chord stress of 7,870 pounds per square inch in a stiffening truss 120 feet deep. This is the stress which has been eliminated by the use of the hinge.

A LIGHTER SUSPENSION BRIDGE—SAME SPAN.

The calculations of the cost of the suspension bridge, which has been described, have been made as nearly as possible on the same basis as the estimates for the cantilever bridge, without taking into consideration the fact that the cantilever bridge would be strained nearly to its full capacity by a load 1,000 ft. long, while the suspension bridge would be fully strained only when covered by a load three times that length. Furthermore, no allowance has been made for the fact that the maximum strains in the stiffening truss would occur only under combinations which might not arise once in a century, and which could be prevented by simple police regulations.

A moving load of 3,000 pounds per foot, 1,000 ft. long, on each of the six tracks, crossing the bridge without change of relative position, would produce practically maximum effects in upward moments on a continuous stiffening truss, but it would produce only one-half these moments downward. In other words, the chords of the stiffening truss would be strained 12,500 pounds per square inch by upward bending, but only 6,250 pounds by downward bending, on the assumption as before that all the moving load is distributed by the stiffening truss; as only about 88 per cent. is distributed by reason of the unsymmetrical deflection of the cable, the maximum chord stresses are reduced and become respectively 11,000 and 5,500 pounds. The greatest upward deflection from the action of the cables occurs from the effects of temperature when the bridge is unloaded; under a full load it is eliminated, and under a 1,000-foot load it is reduced to about one foot, which

corresponds to a chord stress of 1,570 pounds, making a total of 12,570. The downward deflection would never exceed three and one-half feet with the limited length of train, which corresponds to a chord strain of 5,509 pounds, or a total of 11,099, so that a continuous truss could be used without exceeding the assumed limits of stress.

It should be noted that the only condition which would produce these stresses would be the passage of six maximum trains side by side. A single freight train in the most unfavorable position would produce a stress of not over 3,500 pounds in the chords of the stiffening truss, and a single passenger train a stress of not over 1,800 pounds. In providing for a lighter structure, adapted to trains 1,000 ft. long, it has been thought best to make no reduction in the weight of the stiffening truss or the floor system, but the continuous form of truss might be selected.

If the stiffening truss did its complete duty in the distribution of weight, the greatest strain which a train 1,000 ft. long, weighing 3,000 pounds per foot, could throw upon the cables, would correspond to a uniform load of 937 pounds. If the stiffening truss did no duty whatever, but the weight was distributed strictly according to the laws of leverage, the greatest strain which such 1,000-foot train could throw upon the cables would correspond to a uniform load of 1,582 pounds per lineal foot. Under these circumstances it seems safe, while not reducing the stiffening truss, to provide for a moving load on the cables of only 1,500 pounds per foot of track. For this approximate calculation the weights per lineal foot may then be taken as follows:

Suspended superstructure and tracks.. ...	34,000 pounds
Moving load	9,000 pounds
Cables and suspenders	14,000 pounds
Total	57,000 pounds

This is 28½ tons per lineal foot instead of 34 tons, the reduction in the total carrying capacity being about 16 per cent. It should be observed that the live load is only 15 8 per cent. of the whole, so that the additional stress put on the cables by the simultaneous passage of six maximum trains, would, without allowance for the work of the stiffening truss, be only 10,000 pounds per square inch. The stress imposed by a 1,000-foot passenger train under the most unfavorable conditions would not be over 1,200 pounds.

For the purposes of present comparison the suspended superstructure remains unchanged; all other parts may be taken at 16 per cent, less than in the previous estimate. The weights and cost of such a bridge may then be estimated as follows:

	Pounds.
Suspended superstructure	101,000,000
Towers	64,000,000
Chains and anchor plates	25,000,000
Structural steel	190,000,000
4½c.	$8,550,000
Wire work	5,659,000
Total superstructure	$14,209,000
Substructure	14,684.000
	$28,873.000
Add for viaduct	1,850,000
	$30,743,000

This is $4,625,000 less than the previous estimate, and $4,020,000, or about 15 per cent. more than the cost of the cantilever with the 2,000-foot clean span.

This estimate has been made for the purpose of comparing, on the same basis, that of a factor of safety of three on ultimate strength of metal, the 2,000 foot cantilever and the suspension bridge when carrying train loads 1,000 feet long.

If it be thought that the stress of 60,000 pounds per square inch on the wire in the cables is too high, it may be noted that the difference in the cost of wire work in the two suspension bridge estimates is $1,017,624, and if the higher cost is restored it will be equivalent to reducing the stress in wire to about 50,000 pounds per square inch. With this change the cost of the lighter structure becomes $31,671,000, this being $5,038,000, or about 19 per cent. more than that of the 2,000-foot cantilever.

If only one train is allowed on one track at a time, maximum stresses will occur in the different members no oftener than the same loads would produce maximum stresses in the 2,000-foot cantilever. Moreover, the load of 1,500 pounds per foot adopted for the cables is the full weight of a passenger train, and would not be exceeded if the entire span were covered with the heaviest class of passenger equipment. . . .

CONCLUSION.

The only subject referred to your Board is to "recommend what length of span not less than 2,000 feet, would be safe and practicable for a railroad bridge to be constructed over the Hudson River between Fifty-ninth and Sixty-ninth streets."

A single span from pier head to pier head, built on either the cantilever or suspension principle, would be safe.

The estimated cost of the 3,100-foot clear span cantilever being about twice that of the shorter span, your Board consider themselves justified in pronouncing it impracticable on financial grounds.

As the cost of the single span suspension bridge is almost one-third greater than that of the 2,000-foot cantilever, your Board are unable to say that such greater cost is enough to render the suspension bridge impracticable.

The Board feel that the contingency attending the construction of the deep-river foundation of the cantilever bridge, even waiving the absolute necessity of carrying this foundation to rock, is enough to balance a part of the greater cost of the suspension bridge.

The conclusion of this Board is that of a Board of Bridge Engineers acting in a professional capacity. While from such professional view they must pronounce the suspension bridge practicable, they do not in this conclusion give an opinion on the financial practicability and merit of either plan.

Before closing your Board desires to state particularly that the estimates have been made for comparative purposes, and are not to be taken as a measure of absolute cost.

The Bogart Crossing Signals.

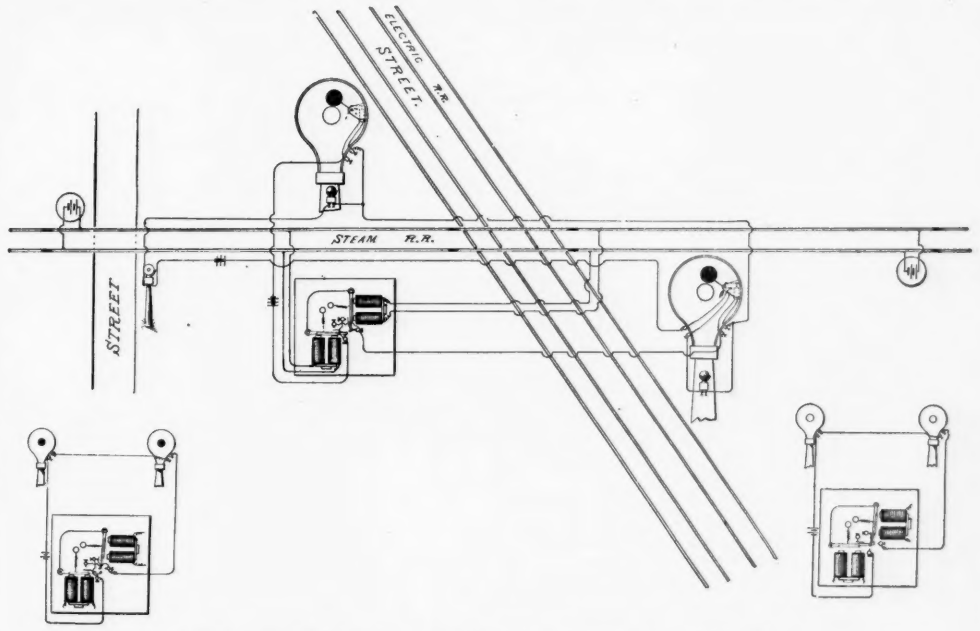
The accompanying illustration shows an arrangement of automatic signals, recently made by the Electric Selector & Signal Company for the New York, Susquehanna & Western Railroad, near the Riverside Station. At this point the railroad track is crossed by a double track trolley road, and also, about fifty yards further by a highway. The crossings are on a considerable grade and at a point where the view of trains coming down grade is somewhat limited, thus making it a peculiarly awkward spot. The railroad has already thoroughly protected the place with gates and highway bells. The instalation made by the Electric Selector & Signal Company was to give additional safeguards.

At the trolley crossing a combined signal and crossing gong is erected on each side of the railroad track, each signal facing the respective motor man as he approaches the crossing. The track connections are about 300 yards on either side of the crossing; the total lengths of bonded rail being 1,800 or 1,900 feet. When a train strikes a track connection on approaching from either side of the crossing, it throws the two signals at the crossing to danger and energizes their bells. When the train has passed the crossing it opens the circuit and the signals are restored to safety their bells being stopped at the same time. Theadjacent highway crossing bell is operated in a similar manner off the signals at the trolley crossing. As a train approaches it energizes the bell and after the train passes the crossing it ceases with the others.

The particular merits claimed for this system are simplicity of connections, small battery power, wide margin on all sections and ease of installation and adjustment, with economy both in construction and maintenance. These signals have been in operation long enough to demonstrate their reliability and efficiency and have not yet had a failure to record.

The system is the invention of Mr. S. S. Bogart, the General Agent of the Electric Selector & Signal Company, and is a part of a wider system of automatic signalling which he has designed, based upon his simple form of automatic electric signals. The following is a short description of the system in general.

When a train passes into the section, the track battery



Bogart Crossing Signals on the New York, Susquehanna & Western.

holding that section closed is short circuited and the battery cut out, allowing the armature to be pulled back by its spring against the back stop, thus opening the signal circuit and causing the banner to fall by gravity to danger. When in this position the contact opens and closes on the signal frame and the bells are vitalized.

As soon as the engine passes over the crossing into the other section, the second armature opens, passes its lock over the first armature, thus preventing the same from closing, and is held in this position until the train passes out of the section. The bell has stopped ringing when the engine has opened the second armature. This is accomplished by the connection between the front stop of one armature to the back stop of the other, carrying the circuit to the two back stops exactly as it stood on the front stop. The small sketch in the left hand corner of the plate shows the first position; the one in the right hand corner, the second.

The signal carries a 15-inch banner of the company's "Eureka" transparent material, mounted on an aluminium frame operated by a magnet whose armature acts as a principal weight in restoring it to safety. One of the points claimed for this system is, that when either of the circuits is opened the signals go to danger, and the bells ring.

The arrangement for double track is equally simple. If desired all the batteries and relays can be combined at the crossing. When the wheels of a train are on a section, the track battery is cut out and its relay circuit opened, thus allowing the armature to be pulled back, opening a contact point and the signal circuit and allowing the signal to fall to danger. When in that position the bell contacts are closed by the signal armature and the bells are vitalized. As soon as the train has passed over the section the relay is again vitalized by the track battery and the signal is drawn to safety. It may be found desirable to drop both signals and ring both bells. In that event the opposite signal and bell can be looped in each circuit. Where the signals and bells or the bells alone are used at highways, and all of the parts are concentrated at the crossing, the ground circuit is dispensed with and a metallic or two-wire system used.

Engineering Education.

We gave last week abstracts of a number of the papers presented at the Brooklyn meeting of the Society for the Promotion of Engineering Education. Below appear abstracts of still other papers: We are informed that all of these, with the discussions, will be published in a volume which will be placed on sale. The volume containing the papers of the first meeting, that at the Engineering Congress at Chicago, is a valuable addition to engineering literature and has found considerable sale.

SOME GERMAN TECHNICAL SCHOOLS.

By Prof. Storm Bull, Univ. of Wisconsin.

This paper is a result of a visit in 1892 to schools at Hanover, Aachen, Karlsruhe, Zurich, Munich, Dresden and Berlin, by Prof. Bull, himself a graduate of Zurich.

T ese schools have changed much in ten years past. Berlin, being at the capital, has been much improved, and at the expense of Hanover and Aachen. It is now the best in Germany, both in equipment and teaching force. Similiarly, Dresden, Munich, Karlsruhe, capital cities, have also made progress, less than that of Berlin, although retaining such men as Dr. Gustave Zeuner, Prof. Bauschinger, and Dr. Grashof, the two latter until their recent decease.

The number of students are: Dresden, 394; Karlsruhe, 587; Munich, 891; Berlin, 1891; and of these latter 800 are in mechanical engineering.

Zurich stands well in the front rank. Its physical laboratory is uequalled; its chemical, unsurpassed. It has been unable to retain Reuleaux, Clausius and Zeuner; but there remain Cullman, Fliegner and Ritter. The number of students is 1,089, one-half of them foreigners. The entrance requirements are a bar to many; in German schools a certificate from a preparatory school serves. The success of Zurich is due to good equipment and good methods, with well-devised courses of study.

In Germany, instruction is by lectures exclusively; in Zurich, lectures supplemented by review recitations, and to these attendance is practically compulsory. Books of reference in addition to lectures constitute preparation for these recitations. In Zurich, students are compelled to learn; in Germany simply given opportunity to learn.

The preparation in Germany is about two years in advance of America. If the lecture system is suitable to freshmen there, it would be proper for juniors here. The Zurich system works well. The personal relations between student and professor are almost as close as here, which is not true in Germany. Notes taken by students are duplicated by some process with professors' knowledge and assistance. Lectures explain, sooth the way, and save students' time.

In German schools work in machine shops is not required or much encouraged. In general engineering laboratories, the foreign schools are deficient, but collections of models are commonly very large. The number of assistants is small, due mainly to lack of the laboratory practice which explains the large number here.

ORGANIZATION AND CONDUCT OF ENGINEERING LABORATORIES.

By Prof. G. Lanza, Mass. Inst. of Technology.

The objects of the laboratory are:

1. Practice in experimental work common to engineers, and to give force to class-room work.

2. Opportunity for original investigation, such that results may be valuable.

3. By publication to add to the stock of common knowledge.

It should be primarily for purposes of instruction. No general rules can be given as to the special equip-

ment for a given case. Yet equipment should be of practical size, used under conditions of ordinary practice, such that careful, accurate work can be insisted on; it should allow experiment to supplement class-room work, and be selected to secure variety, not duplication of experiment.

The laboratory of the Massachusetts Institute of Technology is described and classified.

1. Laboratory of applied mechanics, for testing materials; this includes a 300,000 lb. Emery testing machine, with other important testing machines of well known types, not readily described briefly.

2. Hydraulic laboratory; a fundamental feature being a closed steel tank 5 feet in diameter, 27 feet high, with stand pipe 70 feet high and with further equipment of orifices, weirs, nozzles, measuring tanks, meters, turbines, etc.

3. Steam laboratory with a large triple expansion engine the important feature, but with many smaller engines, pumps, calorimeters, etc., in addition.

4. Miscellaneous, being an indescribable residue.

Laboratory work should supplement class-room work, with the advantages that time is saved in explanation of apparatus as the student is able to depend less on the instructor in making up results, and tests following class-room work better develop the student.

To secure good result, it is necessary that there be sufficient instructors to assure good work, that care and accuracy should be insisted on, that each student make all calculations following the test, and that these be critically corrected by the instructor. Such precautions secure results of value. Apparatus requiring it may often be explained by blue prints submitted for students' examination.

The discussion showed that those connected with other large laboratories were in harmony with the opinions here expressed. The value of giving point and developing interest by experiment in useful and undetermined directions was agreed upon, and several interesting illustrations given.

Another classification of equipment in laboratories was:

1. For investigation of materials.
2. For investigation of machines.
3. For investigation in the way of research.

THE EQUIPMENT OF ELECTRICAL LABORATORIES.

By Prof. D. C. Jackson, Univ. of Wisconsin.

The laboratory should be for undergraduate use, and under control of the professor of electrical engineering, not of physics, although the laboratories need not be separate. Of four divisions of electrical studies, electromagnetism, electro chemistry, alternating currents, special applications; these require laboratory. Laboratories valuable for purely educational development and one-half of the time for electrical studies should go to laboratory, and class-room work and laboratory should supplement each other. Apparatus should conform to actual practice.

The three divisions of laboratory equipment, dynamo, electrolysis, alternating current, are described. Apparatus not essential for undergraduates may profitably be added, and is almost essential for thesis work.

MINIMUM LABORATORY WORK AND EQUIPMENT.

By Dwight Porter, Mass. Inst. of Technology.

Laboratory work is practically indispensable; in general about one-quarter of the time given to class-room should be given to laboratory. The object should be primarily instruction; experiments should be carried only far enough to secure this. Students familiar with chemical or physical laboratory require less of engineering laboratories than others, and the former laboratories, if at hand, can be used for certain lines of work not otherwise justifiable on account of expense.

Of primary importance are tests of materials, and a list of suitable pieces is given with prices. In the hydraulic laboratory there is required apparatus to measure in different ways the flow of water, wiers, meters, nozzles, tanks, and floats constitute a suitable plant. All engineering field work is laboratory work but a few only of special pieces of apparatus are specified. For geodetic work, considerable special apparatus is needed. Something also of steam laboratory experiment is useful for civil engineers if a mechanical engineering laboratory is at hand.

The discussion established the fact that the equipment specified constitutes the least a school should rest satisfied with, although civil engineering can of course be taught, but less efficiently, with less There was a very general complaint from those present that it was difficult to convince the college authorities of the absolute necessity of laboratory apparatus for many of the smaller schools.

THE TEACHING OF STRUCTURAL ENGINEERING.

By Prof. Edgar Marburg, Univ. of Pennsylvania.

The amount of time given to structures in engineering schools is justifiable on the following grounds:

1. Civil engineers are constructors.
2. Structural engineering is developing rapidly.
3. Structural engineering is especially attractive.
4. Except railroad engineering, no subject enlists so many graduates

In mechanics of materials, with frequent problems, work is brought close to practice by use of blue prints and hand books from well-known firms. Graphical statics should be taught, but not to the neglect of even more necessary analytical methods. Following mechanics of materials, design may begin with the plate girder, and this may run concurrently with theory of stresses. The student should be fitted for the duties of his early practice. In this connection lettering should receive careful attention. Designs should be in harmony with specificatons in the hands of students. Blue prints of actual designs should be used with students only when the latter are prepared to critically understand them. Students should learn to use Thatcher's calculating instrument. Excursions to bridge works or structures during process of erection should be made. Some subjects not possible of complete treatment may be touched upon, for their general bearing. If possible the æsthetic side of the subject should receive attention.

The discussion developed a difference of opinion as to the policy of measuring and drawing existing structures previous to the theoretical training; and afterwards wandered away to column formulas and factor of safety.

TEACHING MACHINE DESIGN.

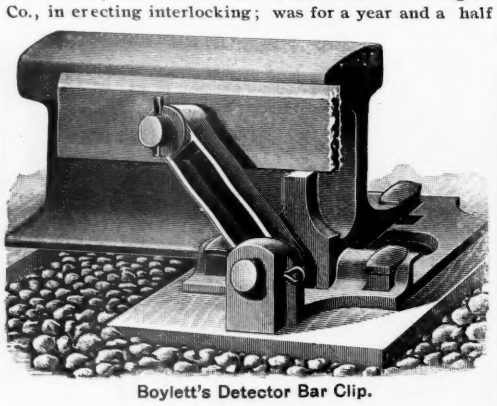
By Mr. John H. Barr, Cornell Univ.

Few students have real talent for design. Much can be done by cultivation, as is true in art or literature; an operator, superintendent or inspector of machinery needs drill in details of design. Students with talent will supplement instruction by reading. The requisites of a machine are adaptability, strength or stiffness, economy in construction and operation. An additonal feature desirable is appearance. All three elements are functions of economy. Character of design depends on use; for infrequent use a single machine construction reducing cost of pattern-making is best; for machines in large demand, large sums can be spent in patterns or plans to secure ideal results. Courses in moulding and pattern-making are valuable adjuncts. Work of manual training schools funishes a good preparation. Knowledge of processes of construction is fundamental. Use of standard forms is an important pactical matter. Present text books tend to treatises on theoretical mechanics. In connection with theoretical instruction and in addition to problems, a drill in drawing-room work should be given, as also exercises in sketching and measurement of parts. Exercises can be given which will force the student to observe and examine the details of machines in use by him. For equipment, models may be useful, but many in use are worse than useless. Trade catalogues have great value.

In machine design, larger colleges have some advantages in laboratory equipment, with danger, however, of diverting student from design. Small classes on the other hand are advantageous.

Boylett's Detector Bar Clip.

The engraving shows a clip for carrying detector bars, designed by Mr. James H. Boylett, of Poughkeepsie, N.Y. A set of these clips was put in track at Poughkeepsie June 20 and they are said to be giving perfect satisfaction. The clip is made of one piece of malleable cast iron, wih a link also of malleable iron. It will be seen that it rests upon the tie and is provided with a clip which goes over the flange of the rail, the rail resting in it as in a chair, or on certain forms of tie plate. Directly back of the link, that is, between the link and the rail, will be seen a stop on which the detector bar rests in its lowest position. This stop is cast as an integral part of the clip. The objections to the ordinary forms of detector bar clip which Mr. Boylett has sought to overcome we give below in his own words, merely stating that he was for several years foreman for the Union Switch & Signal Co., in erecting interlocking; was for a year and a half



Boylett's Detector Bar Clip.

in charge of maintenance of signals on the New York, New Haven & Hartford and was general foreman in charge of the 102 towers on the Hudson River division of the New York Central & Hudson River:

That they are not safe, as I have several times seen bars thrown under trains. The downward projection is a very objectionable feature on account of freezing. It is a frequent occurrence for trains to carry cars past their destination as the towermen cannot unlock their switches when the clips are frozen.

That being fixed to the rails the creeping carries the clip along and throws the bar out of adjustment; the effect of this is that the car wheels run on the bar and bend and loosen the studs when it is one position, while in the reverse position the movement is retarded, and if connected to lock and switch movement the plunger fails to lock the switch, at the same time straining the connections

That with an average amount of traffic over them they will not wear more than three years, which makes them very expensive.

My clip successfully overcomes these admitted objections. The whole device is secured by no more complicated means than that ordinarily used in fastening rails to ties, and requires no auxiliary attachments; is all comprised in one compact body adjacent to the rail; does not project downwardly beyond the level of the tie; is adjustable with respect to rail heads and bases of different widths; is readily transposable, and provides a series of rests to prevent any further lowering of the bar, and does not require any changes to be made in the present connnections.

A New Inside Iron Roof for Cars.

The illustrations show a new inside iron roof for cars. It will be understood from fig. 2 that 2-inch strips of wood, spaced the width of the sheets of metal, extend from the ridge pole to the eaves; over each strip is a strip of metal with gutters turned up on both edges; the space between the gutters is just the width of the strip of wood. The flanged edges of the wider sheets are turned into the gutters of the narrower ones. Another strip of wood bolted through the first one to the framing of the roof cover both gutters. The wider sheets of metal have shallow corrugations near the joints thus made.

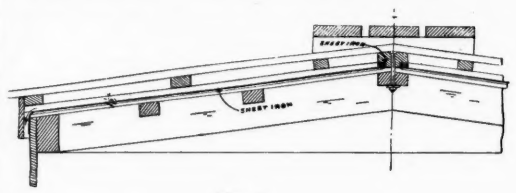


Fig. 1.

The wide sheets extend from ridge pole to the edge of the eaves and are not nailed to the roof; the interlocking of the edges of each sheet in the gutters of the narrow strips prevents movement longitudinally in the direction of the car roof. The ends of the sheets are up-turned under the ridge pole and a narrow strip of wood slipped in between the up-turned edge, and the ends of the binding strips over the joints prevents the sheets from sliding off over the eaves. This construction makes it unnecessary to nail the sheets over the siding, and gives all possible play, so that the wearing of the roof frame is not contributed to the sheets.

Cars standing on an inclined side track will not leak from water running back on the sheets. Because the sheets extend only one half the width of the car, they are not broken from wearing of the car, as sometimes happens when sheets extend the full width of the car. In case of injury to a sheet only that part from the one side to the ridge pole need be removed, thus greatly reducing the cost of repairs. When the new roof is applied to old double board-roofs and the under course of the old one is allowed to remain, the sheets come midway between the two courses and there is no chance for moisture to lodge between the wood and metal to hasten corrosion.

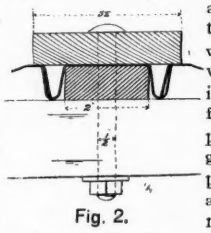


Fig. 2.

The roof was patented in June by Mr. C. M. Jennings, and is being manufactured by the Excelsior Car Roof Company of St. Louis.

The Trapp Compressed-Air Automatic Dump-Car.

We illustrate herewith a dump car designed and patented by Mr. E. A. Trapp that has some new features. One is the separation of the car body from the dumping machinery. The dumping machinery is attached to a frame or platform which is entirely free from the car body, but is placed under it so that it can be used to tilt the body. It is held that the car-bodies are liable to distortion from unequal loading and the effects of the weather, which distortion prevents the free operation of the dumping machinery when it is connected directly with the box. It is further claimed that with the frame detached from the body the dumping device can be applied either to old cars or to new cars not designed with special reference to compressed air devices.

This frame or platform is shown in Figs. 2 and 3 in two positions. As may be seen, the car body is entirely free from the dumping machinery. The car body and load are not carried by the frame but by four center bearing castings, all of which have an oblong slot for the bearing pin. This slot allows a lateral motion of about 6 inches when the car is dumped, thus securing a greater angle of inclination than is possible if the body is pivoted fast in the middle on the same height of car. This lateral motion gives to the car floor an inclination of 48 degrees and insures the complete discharge of the load Two of these center bearing castings have jaws or horns which prevent the box from going too far, and also actuate it in its lateral movement, as well as to return it to its normal position. These castings are shown in Figs. 4 and 5; the lower castings are supplied with rollers upon which the jaws or horns work.

The dumping machinery is simple in construction and the friction is reduced to a minimum. All the movements affected by compressed air are positive, no springs being

employed in dumping or in returning the body to its normal position. The dumping cylinder is rigidly secured to the truck frame and does not oscilate. There are two pipe lines for compressed air, one which supplies the auxiliary reservoir of each car and the other which is only for the purpose of operating the automatic valve which sets the dumping macninery in motion. The locomotive runner has the same control of the transportation and discharge of the cars as he has of the brakes of the train. The system is practically the same, the air being conducted from the locomotive storage tank to the auxiliary reservoir of each car by one train pipe. The other train pipe is connected with an automatic valve with which each car is supplied. When air is admitted

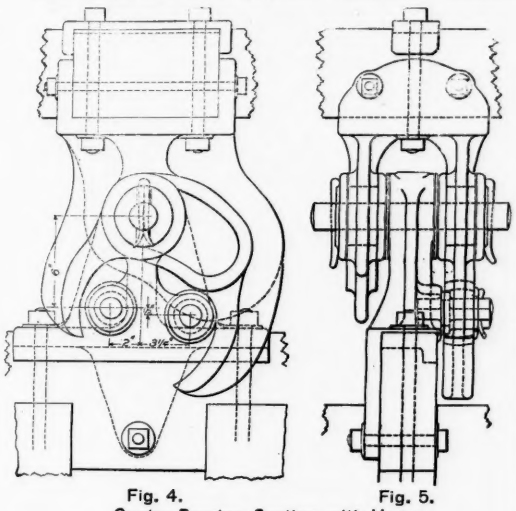


Fig. 4. Fig. 5.
Center Bearing-Casting with Horns.

to this secondary train pipe by the engineer, it actuates the valve of each car which opens communication between the auxiliary reservoir and dumping cylinder, and the car is dumped. Compressed air is then admitted by the engineer to the train pipe, and the car bodies return to their normal position, where they are secured by the latch shown in Figs. 2 and 3.

Each car is provided with an adjustable cut-off valve, by which the supply of compressed air can be regulated to suit the load or the material to be dumped. Any one of the cars may be cut out for the time being and it may be dumped when disconnected from the train either by compressed air or by hand. The latch which holds the platform in position while being loaded or in transit requires neither extra air cylinders nor lever arrangement, and it requires none of the dumping power to operate it.

Each car is operated directly by the compressed air stored in its auxiliary reservoir, the compressed air from the pump being used only to set the automatic dumping apparatus of each car in motion. It is therefore possible to dump long trains of cars at a time, all being operated at the same moment as one, the number of cars depending only upon the hauling capacity of the locomotive.

The door, as shown in Fig. 3, is suspended from a frame. When the car is dumped it offers no obstruction to the material passing it, and its hangings are provided with some lost motion, so that the body shall retain the full load in the box until it is completely over-balanced. Attention is called to the simple yet strong construction of the car and of the dumping machinery. The stroke of the dumping piston is regulated automatically by stops which arrest the working lever, and this saves the cars from the heavy shocks which are the chief cause of repairs and breakage.

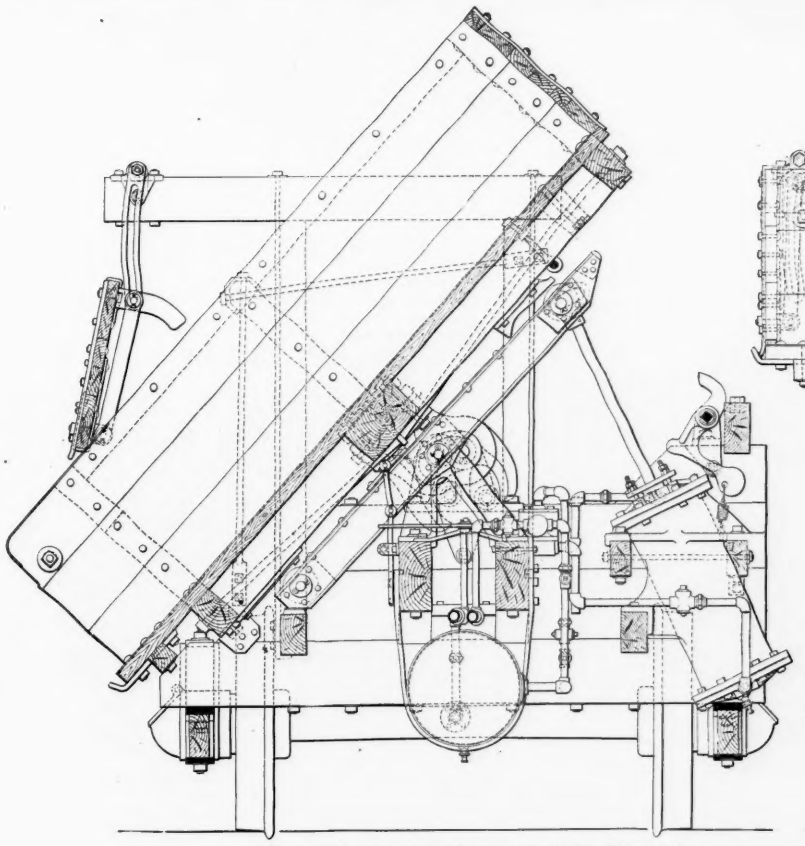


Fig. 3.—Sectional End Elevation of Car Dumped.

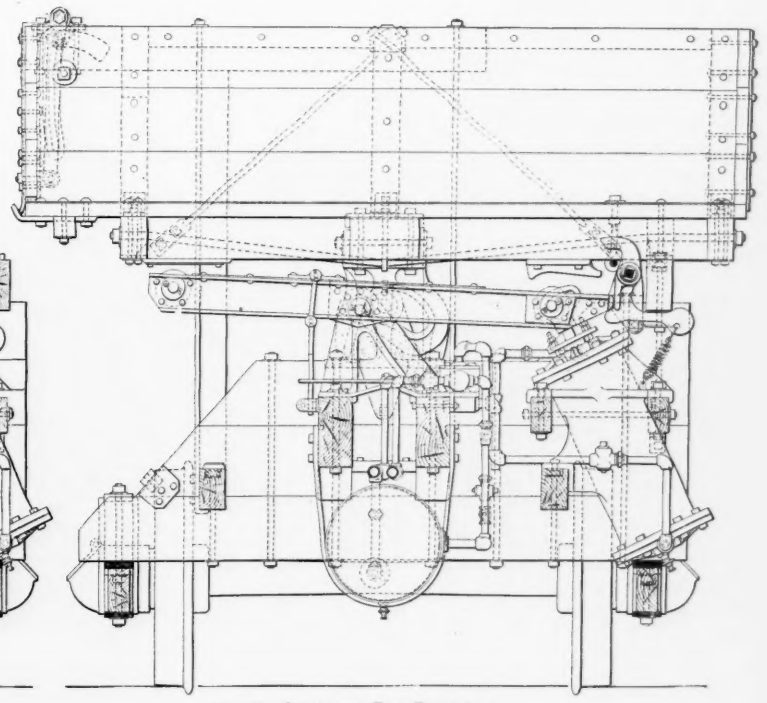


Fig. 2.—Sectional End Elevation.

THE TRAPP COMPRESSED AIR AUTOMATIC DUMP-CAR.

The Southern Railway Co.

On Sept. 1 the reorganization of the Richmond Terminal system was definitely and formally completed, and the last of the many properties which under the plan of reorganization have lost their unhappy and unfortunate identities and become merged in a new and propitious enterprise, passed into the possession of the Southern Railway Co. That date, therefore, marks, for all practical purposes, the completion of the reorganization; and a consideration of the situation, is, therefore, opportune, practically when it is borne in mind that the event is the most notable that has taken place in the history of American railroads, and that its bearing upon every Southern business interest is of vital importance.

The Southern Railway Company operates 4,500 miles of railroad and about 150 miles of water line. With the exception of 491 miles (Goldsboro, N. C., to Atlanta, Ga.), which is leased, all the system is owned by the company, and the heretofore complicated and expensive plan of control by majorities, wholly impracticable and unfortunate in its operation and sure to make enemies among the minorities, is done away with. The old Richmond Terminal Co. did not own any railroad at all, and the much vaunted (but intrinsically worthless) Richmond & Danville owned only 15 miles. The rest of the Richmond & Danville system was made up of some 30 separate companies, ranging in length from 6 to 552 miles. Efficiency and economy were impossible on this basis, which also afforded good opportunity for objectionabl emethods of accounting. The organization of the East Tennessee was more compact, but it, too, left much to be desired.

As a result of the reorganzation over 30 corporations, whose affairs and securities were interlocked in every conceivable way, and in almost hopeless confusion, are united in one company. Thirty Boards of Directors and 30 sets of separate accounts disappear simultaneously. The original plan was dated May 1, 1893; it was issued on May 23, 1893, and the response of security holders was prompt, and by the middle of June, 1893, success was assured so far as their co-operation was concerned.

The Summer and Autumn of 1893 paralyzed the South, in common with the rest of the country, and railroad earnings shrunk greatly. New conditions and new complications were presented, and the problem became one of dealing with bankrupt receivers as well as bankrupt corporations. By strenuous efforts everything was held together, and as soon as possible some amendments to the original plan were promulgated, mainly to solve the financial problems of the receiverships, and also to cut down the interest charges of the reorganized company pending a return to normal conditions.

These amendments were made public on March 1, 1894, and they were so reasonable in character that they were

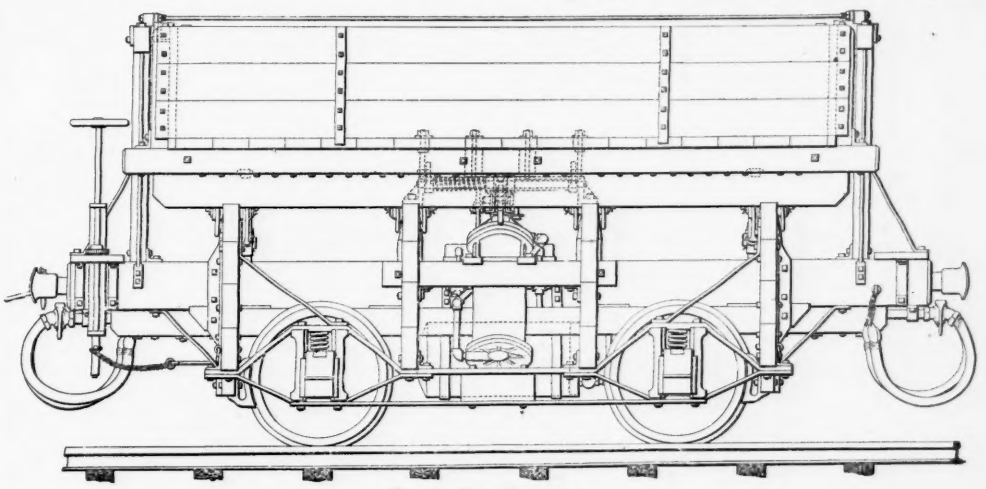


Fig. 1.—Side Elevation.

quickly accepted by the security holders, and the reorganization was at once pushed forward with such rapidity that within four months the new company was formed, and now, within two months more, the last of the property comes into its possession—4,500 miles of railroad which, exactly six months ago, had almost dropped to pieces, and which but for the strong hands that held the properties together during all the financial troubles, would have dropped to pieces, are now brought into one compact and efficient company. The new company is organized under a charter granted by the Legislature of Virginia, supplemented by its conformity to the laws of all the other States in which it owns property.

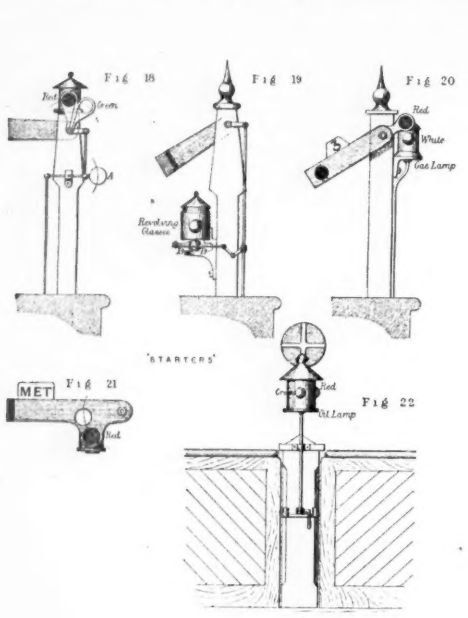
The reorganization has involved two trustees' sales, viz.:

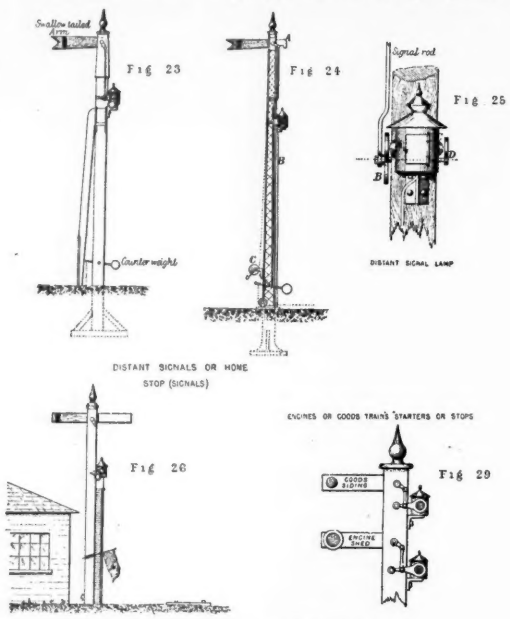
Richmond & West Point Terminal Railway & Warehouse Co.
Trustee's sale under 6 per cent. collateral mortgage.
Trustees' sale under 5 per cent. collateral mortgage.
One receiver's sale, viz.:
Richmond & West Point Terminal Railway & Warehouse Co.
Ten foreclosure sales, viz., covering.
Richmond & Danville and its leased lines.
East Tennessee, Virginia & Georgia (under two mortgages).
Charlotte, Columbia & Augusta.
Columbia & Greenville.
Louisville Southern.
Georgia Pacific.
Western North Carolina.
Northwestern North Carolina.
Oxford & Clarksville.
Clarksville & North Carolina.
Six conveyances without foreclosures, viz.:
Atlantic, Tennessee & Ohio.
Richmond, York River & Chesapeake.

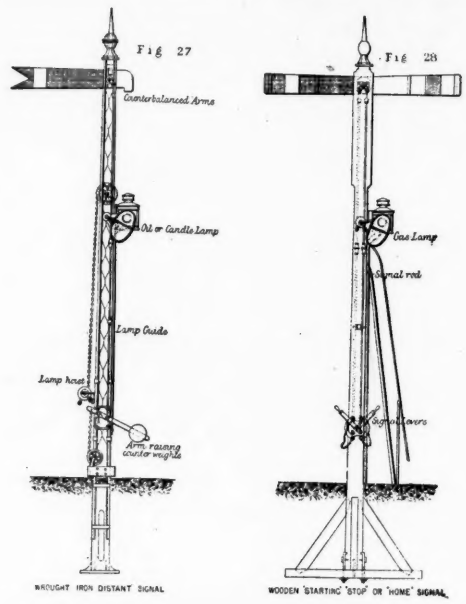
Washington, Ohio & Western.
Piedmont.
Statesville & Western.
Oxford & Henderson.

And we undersand that some half dozen minor sales and as many more conveyances of other kinds are now in progress in order to perfect the minor details of the work.

Prior to the reorganization, the properties now merged into the Southern Railway Co. were covered by about 70 separate mortgages. About 40 of these mortgages have been eliminated in one way or another.

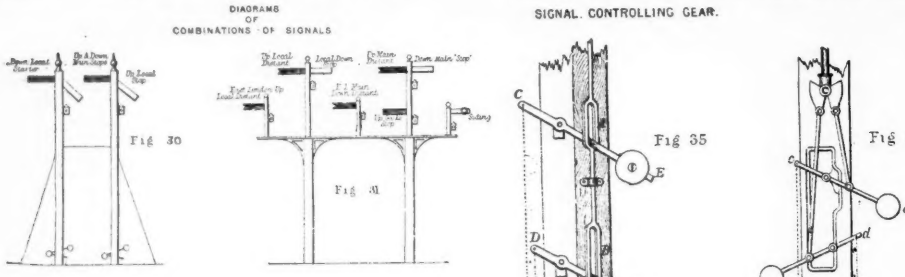






History of Railroad Signals.
"Plate 82," with paper by Mr. A. H. Johnson.

Decribed briefly, and ignoring many small branch lines, the Southern Railway Co. extends from Washington, or, more properly, from Alexandria, Va., and from West Point and Richmond, Va., via Salisbury, N. C., to Augusta and Atlanta, Ga.; and thence to the Mississippi River at Greenville. At Salisbury another main line crosses the State of North Carolina by way of Asheville; thence over to Knoxville and Chattanooga, Tenn., and from there to Rome, Ga., where it divides, one line going to Brunswick and the other to Meridian, Miss. Another line runs from Louisville to Lexington and Burgin, Ky., there connecting with the Cincinnati Southern.



History of Railroad Signals.
"Plate 88," with paper by Mr. A. H. Johnson.

The Cincinnati Southern and the Memphis & Charleston were included in the plan of reorganization as originally promulgated, but were dropped from the amended plan, as the security holders failed to accept the terms offered. They have not bettered their condition by their refusal, and the general impression is that, sooner or later, these lines will be acquired. The Southern Co. is also expected to control the Central of Georgia when reorganized.

Among the most important cities reached by the Southern Railway are Washington, D. C., Alexandria, Va., Charlottesville, Va., Richmond, Va., Lynchburg, Va., Danville, Va., Raleigh, N. C., Durham, N. C., Greensboro, N. C., Statesville, N. C., Asheville, N. C., Salem-Winston, N. C., Charlotte, N. C., Columbia, N. C., Spartanburg, S. C., Greenville, S. C., Augusta, Ga., Atlanta, Ga., Macon, Ga., Brunswick, Ga., Bristol, Tenn., Louisville, Ky., Lexington, Ky., Knoxville, Tenn., Chattanooga, Tenn., Rome, Ga., Birmingham, Ala., Anniston, Ala., Columbus, Miss., and Selma, Ala.

The lines of the company, located as they are, reach and serve all of the diversified intersts of the South. In the way of mineral, they penetrate its two great coal fields, viz., the Kentucky and Tennessee coal fields on the north and the Alabama coal field on the South, and from these are able to supply all the States traversed by them. They also reach the great iron industries of the South at Knoxville, Cleveland, Chattanooga, Anniston, Birmingham, and intermediate points. Iron is made cheaper at Birmingham than at any other place in the United States, or, for that matter, in the world. On the Western division of the system there are over 30 iron furnaces. Through innumerable small branches the company goes into the very heart of the lumber territory in the States through which it runs. It is able, of course, to draw cotton from every direction, not only on its own lines, but from its connections, and it penetrates the sections of North and South Carolina and Georgia which are occupied by cotton mills. The growth of cotton mills along the line is, perhaps, one of its most remarkable features. Right through the hard times new mills have been going up, especially in North Carolina. Its lines in Kentucky enables it to control its full share of the tobacco business at Louisville, and, in addition to this, it penetrates in every direction the country in which tobacco is grown, especially in the neighborhood of Oxford and Durham, in North Carolina, and along almost the entire length of the former Western North Carolina Railroad, which is now a part of its system. By way of Augusta and its connections to Florida it does a very large share of the garden truck business in the Southeastern States. It is the most direct passenger line from Washington to Atlanta and all the intermediate points, and also as short as any line to Florida. The Old Piedmont Air Line, which is part of the system, has long been famous.

The properties embraced in the reorganization had bonded and floating debts of about $135,000,000. This is now reduced to a bonded debt of $94,000,000, including sufficient bonds (which are reserved), to take up all underlying bonds and all the bonds and stocks of the 491 miles of leased railroad. The company will also issue about $6,000,000 more bonds during the next two years, to purchase additional equipment and improve the properties, which will make the total bonded debt of all kinds $100,000,000. The plan of reorganization wisely provides that $20,000,000 of bonds additional (to be strung out through a series of years) may be issued hereafter only for the further development of the property. The interest charges before the reorganization were about $7,500,000 per annum, and sinking funds were about $600,000 to $700,000 per annum additional. The new company's charges are $4,100,000, for 1894, $4,700,000 for 1895, and $5,400,000 for 1896.

The old company was always in such dire financial straits and had such large fixed charges that it could not afford to spend a cent on the property where such expenditures could possibly be avoided, and in this way it really lost business. Furthermore, its financial necessities led it to litigate all claims of shippers for lost or damaged goods, such litigation in nine cases out of ten having for its object simply to procrastinate and delay payment. The new company, organized as it now is, can, of course, follow a different policy, and by fair treatment of shippers is sure to enlarge its business.

Another interesting feature is that, notwithstanding the nominal control of the former East Tennessee, Virginia & Georgia and Richmond & Danville systems by the now defunct Terminal Co., there was no actual control, and the two companies did not co-operate even in the ordinary interchange of business. The jealousy between the two was so great that they preferred to turn business over to some outside connection rather than give it to each other. Another feature is the consolidation of the business organizations and the reduction of expenses at junction points where the Danville and East Tennessee have each maintained separate organizations heretofore.

In several of the Southern States, legislation has been bitterly hostile, and it must be admitted that the way these companies were conducted provoked such legislation. As a result of the reorganization there is already a much better feeling in this respect, and it is certain to grow as the community is better served.—*New York Sun.*

A Historical Sketch of Railroad Signaling.*

[*Continued from page 561.*]

In looking over these old records, one is impressed by the number of devices which we recognize in the many signal patents taken out from time to time by inexperienced inventors. It would take a long time to briefly describe the great number of different devices that have been proposed for signaling, but I will not dismiss the subject without mentioning a signal proposed about 1845, which revolved quickly to indicate a clear track, slowly to indicate caution and was stopped to indicate danger or stop. Hand signals for use in starting, stopping, backing, etc., were introduced at an early day and have changed very little in principle as used to-day.

Detonators or torpedo signals were introduced about 1841 as auxiliary audible signals for use in foggy weather.

In England, where there is much fog, the trackmen have standing orders to report for duty as fog-signal men in case of fog. Each man has his alloted position at a home or distant signal. He takes a supply of detonators and places two of them on the rail or removes them in accordance with the indications of the fixed signal which he serves. Many attempts have been made during the past fifty years to do this fog signalling by automatic machines, working in conjunction with the fixed signals. No such machine has been widely introduced, owing partly to its being a bad principle to depend upon the action of mechanism which is only called into practical use under exceptional conditions, except when, like fire engines,

*From a lecture by Mr. Arthur H. Johnson delivered before Lawrence Scientific School, Harvard University, Cambridge, May, 1894.

the machine can have constant supervision. As before explained, experience proved that the best signal by day is afforded by position and form, rather than by color. Color signals, however, are still used by day in connection with flagging, red meaning stop, green, proceed with caution, and white, all clear or go ahead. Color signals are also used in connection with switch stands to indicate whether the switch is set for the main track or for the diverging track, but there is also usually some distinguishing shape. Color by itself has probably been condemned as a day signal, owing to the prevalence of many other colors in the background, but at night, when there is a dark sombre background, colors have proved to be the most distinguishable. In fact, a strong red light has no equal as a stop signal. It has for many years been the general practice to use the following night signals, viz.: Red for danger, green for caution, and white for all clear. But some roads have used green for the all-clear signal, having in view the possible breakage of a red glass, and thus obviating the danger arising from such breakage.

Plate 82 illustrates several forms of semaphoric signals of some of the earlier types, but the signal of to-day varies very little in general design from these. Fig. 18 was used by the Southeastern Company. There are red and green spectacles to be placed in front of the lamp on top of the post. Fig. 19 was used by the London, Brighton & South Coast. The special feature is the revolving colored glasses inside the lamp introduced by Mr. Saxby, with the idea that the glasses would be the better protected. Fig. 20 was used by the London, Chatham & Dover. It will be noticed that the spectacle is attached to the arm, and it will be well to note in passing that this is the form that has survived all the others. Fig. 21 is used on the Metropolitan Underground. It is designed to be hung on the side of the tunnel. Fig. 22 shows a signal fixed to the platform gate post at a terminus, for the use by the man who starts the trains. In this country a small semaphore mounted on the gate post, has been used for this purpose.

It has come to be one of the first principles of signaling that the normal position of all signals must be the danger position, and should any part of the mechanism fail, the signal should at once fly to the danger position. Although the reason for this rule now appears to be obvious, yet the earlier signals were so constructed that the proceed at speed. It is made mechanically impossible to place the distant signal at "all clear" until the home signal has been placed in that position.

Again referring to Plate 82, signal 27 is fitted with a lamp hoist for raising the lamp to a position opposite the colored spectacle glasses. Lamp hoists have been discarded for many years, as it was found that the men failed sometimes to raise the lamps high enough, and thus the lamps showed a continuous white light. The present general practice is to use wrought iron ladders, as shown by Fig. 28. Fig. 26 shows a simple arrangement of home signals at a plain telegraph block station. The green flag is used in certain contingencies to permit trains to enter a block section that is already occupied, under the permissive system. I shall refer to this matter later, when expaining the Block System.

It is the practice on some lines to use distinguishing marks on the home signal arms. Fig. 29 shows an arm fitted with a ring. This particular signal is used at a terminus for backing out road engines to the round-house or turn-table. It will be noticed in the illustrations that the arms extend to the left of the signal posts, as read by the enginemen. This is common practice in Great Britain where all trains run on the left-hand track, but in this country the arms extend to the right, with a few exceptions, such as the Old Colony and Boston & Albany.

In the best practice the signal posts are painted white, and the front side of the signal arm red with a white transverse stripe. It must be distinctly understood that the color of semaphore signals has nothing to do with their indications. They should be so painted as to make them easy to pick out by the runners of fast trains. On Plate 88, Figs. 30 and 31 show two examples of the arrangement of signals, where it is necessary to have a group at one point. Fig. 31 is termed a bracket signal. On railways having four main tracks signals are sometimes arranged on bridges spanning the tracks each signal being located over the track, which it governs, otherwise they are usually placed on the engineman's side of the track.

In order to secure safety it often becomes necessary that a signal arm shall be under the control of two or more signal men located at different points, and it must take the combined action of two or more men to place the signal at safety, but any one man, by reversing his lever, must be able to place the signal at danger. This is accomplished by what is called a "slot," this term having arisen from the construction of the first apparatus for accomplishing this purpose, shown at Fig. 35. B is a rod attached to the signal arm, and through slots in which pass balance levers E and F, operated by two separate signalmen. It will be readily seen that both balance levers E and F must be raised before the rod B attached to the signal arm, can rise, and that the return of either lever will restore the signal to danger. This was a primitive construction, and the signal arm had to be weighted to the clear position. Fig. 36 shows Saxby & Farmer's scissors slot which was designed to operate an arm properly counterbalanced to danger. Signals are sometimes controlled mechanically by a local man, and electrically by another man at a distance, by what is known as an electric slot.

It is very important that signals should, when possible, be placed so that they may be seen from the signal cabin; but it is sometimes impossible to arrange this, and then it becomes most advisable to repeat their action to the signal cabin, in order that the signalman may assure himself as to the proper action of such signals. The early repeaters were operated by a return wire, a shown by Fig. 37. A is the miniature repeater of the line signal, and it is operated by the return wire as shown. This method proved to be very inefficient and gave place many years ago to repeaters actuated by electricity. Contacts are arranged on the signal arms, and the miniature repeating signal in the cabin is made to correspond with the action of the line signal by the influence of electro-magnets. A bell is made to ring in case the signal fails to correspond with the operating lever.

Owing to the expansion and contraction of wire connections to signals at a long distance from the signal cabin, it has been found advisable to insert temperature compensators, as in practice the men cannot be relied upon to continually adjust the connections by means of the usual turn-buckles. Hundreds of patents have been taken out for signal-wire compensators, but their general principle is illustrated by Fig. 38. A is the operating lever, and C is a pulley over which the signal connection passes, and to the end of which is attached a weight sufficient to pull the wire taut. It is, of course, necessary to grip the connection before the signal can be moved by the lever A, and this is accomplished by the ratchet trip E, which locks the pulley as soon as the small lever is lifted from the stop.

An ingenious compensator was invented by Mr. Henry Johnson about fifteen years ago. It consisted of an iron tube, containing non-freezeable liquid. A plunger is inserted through a stuffing box into this tube. The coefficient of expansion of the liquid being ascertained, enough of it was put in the tube to expel the plunger the proper distance by its expansion when a rise of temperature took place, and thus take up the expansion of the signal wire. Thousands of these compensators have been used in France, England and America, and they were perfect as long as they did not leak, but this point proved to be too delicate for ordinary railroad repair men, and the scheme was abandoned.

The difficulty with weight compensators, as applied to a one-wire connection, is that the varying friction in a long wire, owing to the difference between wet and dry weather, makes the effect of the compensating weight variable, but this has been lately overcome to a great extent by the use of two-wire connections. Fig. 60a, Plate 101, shows another form of weight compensator.

We have thus far considered only signals which inform the engineman whether he may proceed or must stop. We now pass to signals which are placed at switches to inform the trainmen whether they will take the main or the divergent track.

There are a great many different patterns of switch indicators, and Plate 101 will show us some of them. Fig. 68 represents a switch indicator of the semaphore pattern. The two arms and the green and red spectacles are mounted on a common center pin, and connected to the switch by cranks and rods.

When the arms are in the position shown, they indicate that the switch is set for the left-hand track, and that it is set for the right-hand track when the arms are in the reverse position.

There are two lamps to give the night indications. In the position shown there is a green light on the left and a red light on the right, and it will be readily seen that when the switch is reversed the green and red lights will be transposed. Fig. 69 is a revolvable disk indicator, and it makes a quarter turn by being connected to the switch by a rod. Fig. 70 shows a simple form of switch stand. The lever handle for throwing the switch is mounted on the same shaft as the signal.

Fig. 76 shows a similar switch stand, but the switch throwing lever is mounted to swing vertically, and the signal disks are carried high so as to be better seen by fast trains.

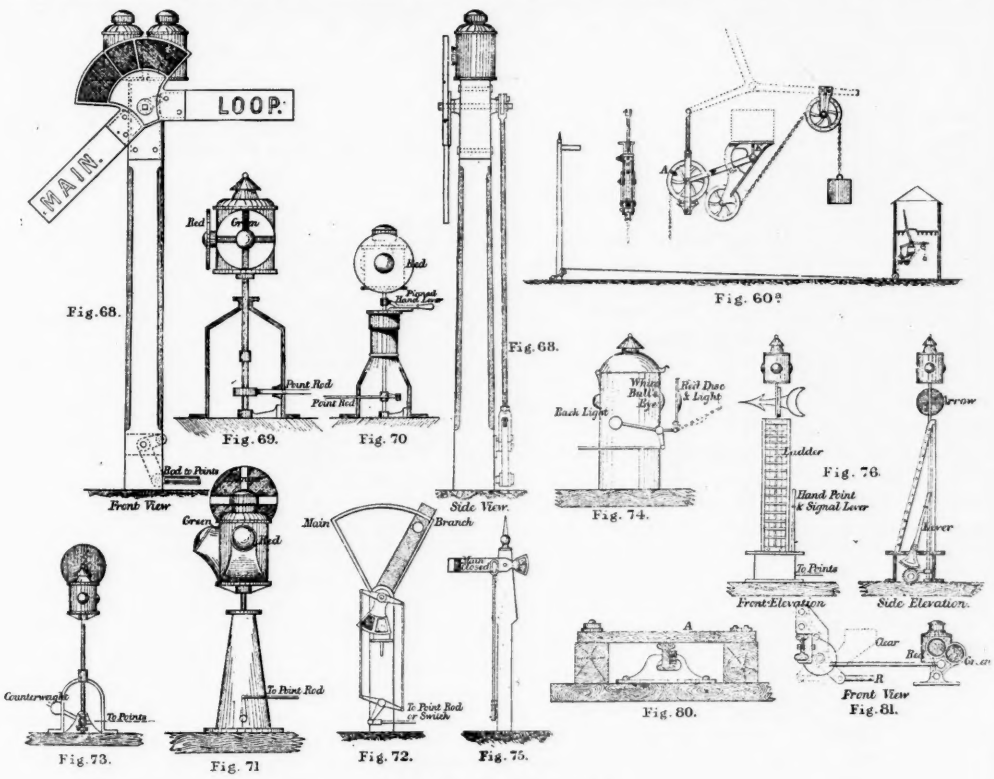
The lenses of the indicator shown at Fig. 71 are inclined upward at about 45 degrees, in order that the light may be better seen from yard engines at short range, while at the same time being obscure to the runners of fast trains, to whom these signals do not apply. Fig. 72 shows a switch indicator which will explain itself. It is similar in design to the semaphore indicator, Fig. 68. There is, however, only one arm and one lantern, and the night signal is white for the main track, and green for the siding. At Fig. 73, the signal is connected to the switch by a wire, the signal being moved back to its normal position by a counter-weight.

In Fig. 74 the lamp case is stationary, and the indications are given by a red disk carrying a red glass. The disk is pivotted to the frame, and is made to cover or uncover the white face of the lamp case by being swung like a box lid.

Figs. 80 and 81 show two forms of Scotch blocks. These blocks are some times used to prevent cars from being accidentally kicked or blown out of a siding on to the main line. Fig. 80 is made of oak and is moved by hand. Fig. 81 is of iron, and is operated by rod connections from a signal cabin. It has an indicator connected to it, to show at night, when the Scotch blocks are clear of the rail.

I will next pass to a brief description of the introduction of the inter-locking system.

(TO BE CONTINUED.)



History of Railroad Signals.

"Plate 101," with paper by Mr. A. H. Johnson.

arm would fall to the clear position in the case of a rupture of connections. Signals 18, 19, 21, 23 and 28 are so constructed, while it will be noticed that the signal arms of 23 and 24 are counterbalanced so as to fly to the danger position when disconnected.

Fixed signals are divided into two principal classes, viz.: Home or stop signals, and distant or warning signals. Home signals have square ended arms, as at 20 and 28, and distant signals have swallow-tailed arms, as at 23 and 27. Their principal distinction, however, is in their relative locations. I can best illustrate this by a diagram. Fig. 1. Signals 2, 7 and 5 are home signals, located at

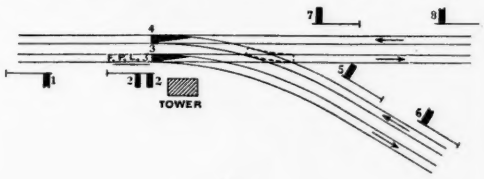
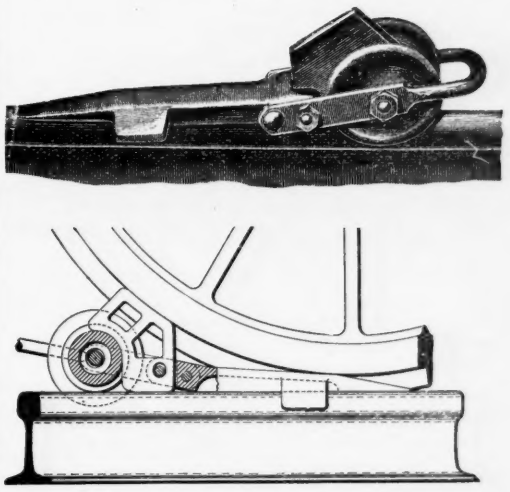


Fig. 1.

the points at which it is desired that trains shall stop when required. Signals 1, 6 and 8 are distant signals, placed 1,000 to 5,000 feet from the home signals, which they serve; the distance being regulated by speeds and grades. Signal 8 is the "distant" which serves home signal 7. The office of the distant signal is to give advance information with reference to the position of the home signal, and its use is made necessary simply by the high speeds at which some trains run. Under some conditions it is impossible for an engineman to see his home signal until his engine is within a short distance of it, and he would therefore be obliged to approach such a signal very slowly. The distant signal enables him to know whether he is to stop at the home signal, or whether that signal stands at "all clear," and he may

The Koppel Stop-Block.

The illustrations represent a stop block patented and manufactured by Arthur Koppel, of Bochurn, Germany. It is in successful use on several German and Luxembourg railroads. The device consists of a tongue of pressed wrought iron, linked by an iron strap to a small double flanged steel wheel which turns easily around the bolt *a*.



The Koppel Stop-Block.

Between tongue and strap a wrought iron brake shoe is placed, turning on a bolt *b*. When a car wheel mounts the tongue it pushes against the shoe which gradually brakes the running wheel. The stop-block is carried along by the car for a short distance, bringing it to a halt without injurious shocks.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Railroad earnings continue to show a distinct improvement, and it was high time. Last week the *Financial Chronicle* published a supplemental table for the half year to June 30, extending its returns to 234 roads working 153,335 miles. These showed a loss in gross of almost eighty-eight million dollars. That journal estimates the loss on the 178,000 miles of the country at more than one hundred millions. The earnings of the 234 roads in the first half of 1893 were $529,311,698, and the loss is 16.61 per cent. The loss in net for 179 roads was 19.59 per cent., or more than 23½ million dollars. But the first half of '93 was not a period of prosperity; the gain in gross having been but 4 per cent. Now, in August, we begin to have comparisons with the World's Fair period, and yet we find actual gains in gross over corresponding weeks last year in the aggregate of the roads from which August reports have been published. Of course these are still too few for one to be able to speak precisely, but the indication is important.

The committee appointed by the Master Mechanics' Association at its last convention to present to the American Railway Association a plan of investigation of the action of steam in locomotives and to ask for an appropriation to meet the expenses of such an investigation is about ready to act. The committee appointed to conduct the tests and outline the investigation, which was also appointed by the Master Mechanics' Association has made a very complete and full report to the committee that is to make the plea before the American Railway Association. This report has been prepared by Mr. William Forsyth, chairman, and contains an outline of what it is proposed to do, the reasons for doing it, the value to railroads of the knowledge that it is expected will be obtained and a close estimate of total cost. The report is in fact quite a complete summary of the advantages and accuracy of shop tests of locomotives, and in it is given a condensed statement of the disadvantages under which locomotive designers work because of lack of accurate information.

The Continuation of the Exhaust Nozzle Tests.

The committee on exhaust nozzles and steam passages, which was continued by the Master Mechanics' Association this year, is about to commence again the experimental work, and will be glad to receive suggestions from those who are interested in any particular feature of smoke box apparatus. Now is the time for those who have claimed advantages for unique construction in smoke boxes to learn the "true inwardness" of the devices which they champion. Such a good chance to get facts is not often found, and the exhaust nozzle, deflector and smoke stack improvers should not fail to take advantage of it.

The committee this year settled several matters of importance, and an account of the work has been published in the *Railroad Gazette*. In general the results showed that a smoke stack is frequently made too large; a straight stack is about as good as a taper one; the lower the exhaust nozzle the larger it can be, and the shorter the smoke box the greater will be the draft with the same nozzle and other apparatus. It is understood that the committee now proposes to carry the investigations farther, to be able to say what should be the dimensions and the location of the different parts in any given case and to define the limits of variation which can be made in the position of the parts without materially affecting the results. For practically identical engines, working under nearly the same conditions and with the same fuel, there are now an enormous variety of designs of smoke box apparatus, many of which work with perfect satisfaction.

It is not strange that so many different designs produce practically the same results, for the reason that there is a wide space between the limits, upper and lower, of dimensions for size and location, or as electricians would say, "a long flat spot in the curve of location," in which the apparatus will work with pretty nearly the same efficiency. It will be impossible to determine which is the *best* of the many different locations for smoke box apparatus as the measuring devices are not sufficiently accurate to detect the small differences in results; neither would it be useful to know the best location as it would lead many to make unnecessary changes, and sometimes go to needless expense to reach the perfect device; but what is useful is to know the limits within which the designer can work and get practically satisfactory results. For instance, given a 19x24 inch ten-wheeler and a definite service and fuel, what we want to know is, what is the largest and smallest stack, the highest and lowest exhaust nozzle and deflector plate position, and the longest and shortest smoke box that can be used on the given engine to get a satisfactory draft on the fires, low back pressure in the cylinders and comparative freedom from sparks and clogging of the netting. When these limits are known then the designer can tell whether there are patterns and drawings already made that will answer for making the castings and guiding the construction for the new engines.

The maximum economy in repairs and construction of locomotives, where there are a considerable number of types and a wide varity of fuel and other conditions to work with, can only be had when there is a continual effort on the part of the master mechanic to avoid making small changes in designs and dimensions and a striving to use as nearly as possible the same details for all engines. This can only be done when the master mechanic knows what variations can be made in proportions and dimensions without materially affecting the efficiency. It is the plan of the committee to determine the practical limits of variation of smoke box designs, and this is the policy of determining limits that should guide the work of the Master Mechanics' Association in order to get useful results which railroad companies may rightfully expect from that organization by reason of the avowed purpose of its existence.

Night Schools for Railroad Boys.

A few weeks ago (July 20) we wrote concerning night schools for apprentices, and gave some particulars of the night schools on the Michigan Central. Since that writing we have some further account of the working of these schools. It appears that the average attendance in the Detroit schools is 20, in the Jackson schools 25, and at St. Thomas 18. The reader will remember, perhaps, that at Jackson the work is especially in matters pertaining to motive power. At Detroit the instruction is particularly on car design, building and repairing, while at St. Thomas both classes of work are taken up in the school. It appears that we were in error in saying that the attendance at these schools is compulsory; but it is well understood among the apprentices that those who are not willing to profit by the opportunity for instruction do not have so good a chance for promotion as those who attend the schools. Furthermore, sons of any of the employees in the mechanical department are allowed to attend these schools and are given the first chance for employment as apprentices when vacancies occur.

Night schools were established by Mr. Charles Paine on the Lake Shore & Michigan Southern years ago when he was General Superintendent of that system, and these are still maintained substantially as they were then established, the term of instruction beginning with October and ending with May. Officers of that company think these schools of great benefit, developing the powers of the men, making them broader, and giving them a greater interest in their work and in the company for which they are working. These schools are situated at Elkhart, Norwalk, Cleveland and Buffalo, and while they are intended primarily for apprentices, other shop men are admitted. We know of no other railroad schools of this class. Of course, there is the well-known school of the Brooks Locomotive Works at Dunkirk, which is designed to accomplish the same purpose for those works as the schools established by the railroads accomplished for them.

In writing of the Michigan Central schools we took the ground that such establishments would do much in the way of breeding among American railroad men a sense of permanence in their places, the real self-respect which comes from education, and a feeling of loyalty towards the company which helps them to get this education. In other words, it would tend to make them substantial and steady citizens and not semi-barbarous wanderers. Since that article was written we have received letters from a number of railroad officers on the subject, some of whom agree with us and some do not. We will quote some of the most important expressions from these gentlemen.

One who had a pretty close experience with the last great strike said that he was a good deal disturbed by the want of a sense of loyalty among the employees. Those who remained loyal were generally the old men who had had a good deal of experience of life, and who had nothing to gain and everything to lose by joining the strikers, but generally they held out in the midst of a great amount of terrorism, and the lack of anything like loyalty in the great mass of employees was astonishing.

And yet the influence of such sch ols as we were speaking of seems to this officer to be of very little value, perhaps even injurious, because it approaches paternalism, and paternalism is to him dangerous. This he considers to have been well illustrated in the last Pullman strike. There the men had no home ties, no property to influence them in deciding whether or not to strike. One of his own yard-masters, who had been through many rough strikes of switchmen, pointed out to him a small house which he owned in one of the suburbs of Chicago. The yard-master had just got the house and land paid for, and he could not be driven to strike. The same man showed this officer, as they journeyed along, a house on which another employee had begun making payments. He struck, but he was one of the first to ask to come back. He realized that unless he got work, and that promptly, he could not keep up his payments and he would lose everything.

Now, all of this points to independence among the men, not independence of the company, but independence as individuals and as property owners, each man working and accumulating for himself. Something towards this may be done by encouraging building associations at towns where there are shops, these to be run, not by railroad officers, but by the citizens. The railroads can help by taking pains to keep the men employed regularly, with full hours; that is, when a squeeze comes, instead of placing orders for work outside, they might throw more work into their own shops. Furthermore, pension funds and various relief benefits, if established and maintained by the employees themselves, would be of very considerable help.

Of course, the men are going to take the views of the great mass of those with whom they are associated, who are of their own kind, and with whom they are in close sympathy; and as they cannot be closely associated with the superior officers they will take the views of the other workmen, and there will necessarily be some feeling of antagonism. Finally, the chief remedies seem to be better means of enforcing the laws, regular work for employees, and encouragement to the men to own property in the places where they work.

Another officer does not seem to be alarmed by the idea of paternalism in railroad schools. He thinks that every railroad ought to try to help in training the boys who are to make the material to operate the lines. The great trouble is that with a limited staff and with the rush with which everything must be done, sufficient attention is not paid to the grist that is poured into the hopper. This gentleman is quite certain that a boy who receives the better portion of his education at the hands of a railroad company, and afterwards enters the employment of that company, is likely to make a better man for the company and to do better work for himself, than any of those who carry their belongings in a cotton handkerchief and tramp the country for employment.

Another officer, a man who has had unusual experience in direct charge of men, says that by far the best men are those who have grown up on the road for which they are working, or, in other words, have passed through an apprenticeship. He has no doubt that were more attention paid by officers to some sys tematic method of training, both mental and manual, of the bright young men, the railroad service would attract better boys, and its efficiency would rise rapidly. It is now very difficult for a boy who wishes to learn a trade in a railroad shop, for instance that of

machinist, to learn it thoroughly. He does not know a single shop in which an apprentice receives a systematic course of instruction towards making him a thoroughly competent mechanic. A boy is put first on one kind of work and then on another, under the direction of any workman in the shop whom it is most convenient to put him with, and some of these workmen are themselves bunglers. Even if they are good workmen, they are often incompetent to instruct or unwilling to; so the boy picks up fragmentary knowledge enough to do fairly well the special work that he has done and comes out a "machinist." He ought more properly to be called a machine, for when you come to put him to work you find that he is a "lathe hand," or a "planer hand," and so on, and he is of little more use when taken away from his special machine than any other inanimate part of that machine would be. Of course it is necessary to specialize shop work, and experts on various machines are almost indispensable; yet these men are not really experts until they are thoroughly grounded in the fundamental mechanical principles of their trade, and to this end they must be taught, during their apprenticeship, by competent masters, not only how to do a piece of work but why it should be done in that way.

This gentleman adds: "I do not believe it is necessary or desirable to go to much expense or establish an elaborate school, as at Mount Clare. I like the German system of putting the apprentices in each department under a master workman who looks after and instructs them throughout their apprenticeship and is held responsible for the kind of journeymen he graduates. This, in connection with a night school, made attractive, as it easily can be made to boys who are daily experimenting in their regular duties in the realms of physics, chemistry, applied mechanics, etc., is all that is necessary to build up men who will be a credit to any management and of the greatest value to the company employing them."

The sort of thing which the social philosophers understand when they talk about paternalism, is the last thing that we should advise in the administration of railroads. We must all often think that there is too much of it even in our own families. An astute and experienced man of the world, talking of this, once said to us: "I would not throw my boy out under a wagon, but I am inclined to draw the line there in my care of him," and yet we all know that the doctrine of individualism can be carried to the absurd; that somewhere it becomes our duty to help our children, that somewhere it becomes the duty of an employer to help the employed, and that the government, whether it be that of a city or of a nation, is bound to have some regard for the helplessness of the individual citizen. The Century Dictionary defines paternalism as, specifically, "excessive governmental regulation of the private affairs and business methods and interests of the people; undue solicitude on the part of the central government for the protection of the people and their interests, and interference therewith." That is, the care of the government becomes paternalism when it is excessive or undue. It is left for the jury to say what is excessive or undue interest in the affairs of the individual.

Perhaps it is enough for our purposes to say that the care of or interest in the employee becomes undue and excessive when it tends to prevent the development of the individual man, and that, on the other hand, it is beneficial when it helps to make him a better and more complete man.

If we accept this notion we may dismiss the charge of paternalism as against night schools established by railroad companies for the benefit of apprentices or of the sons of employees. They provide those lads with the means of getting education which ordinarily they could not possibly get in any other way, and so they help to make those lads better men and really stronger and more self-reliant individuals. If, in every town where a considerable number of such railroad boys are gathered, the town government provided night schools, possibly it might be better that the railroad company should encourage attendance there and should not maintain schools of their own. And yet even there the instruction would not have the specific value of being directed towards the work which these boys will later have to do if they stay on the railroad; and this is just as much paternalism on the part of the town as it would be on the part of the railroad. If the boys' fathers could maintain the schools and the boys could contribute even a little by saving a few of their scanty pence, possibly the effect on the individuals would be better. They would feel that they were helping themselves, and that they stood squarely on their own feet and owed nothing to the favor of anybody; but such an arrangement would seldom be possible, and so ordinarily the question comes down to whether the railroad company shall help the boys to a little education by maintaining night schools, or whether it shall let them drift, and train themselves in the bar-rooms and on the street corners.

We are inclined to think that there is no loss of self-respect or self-reliance among the lads who attend such schools; but that on the other hand, the feeling grows in their minds that they are respected by the company, that they are useful and valuable to it, and that they and the division superintendent and the superintendent of motive power and the general manager are all part of one machine, with a common interest, sharing in a common prosperity and affected by the same adversities.

We are not talking now of all the various ways in which railroad companies can help to create among their employees a spirit of real self-respect, as well as one of loyalty towards the company. The sense of security can be cultivated by the establishment of pensions and relief funds of various sorts, and the sense of personal independence can be cultivated by leaving the management of such concerns in the hands of the men themselves, the railroad aiding by contributing some percentage of the fund. The whole moral and physical condition of the men can be improved by establishing reading rooms and amusement rooms, with beds and baths and cheap, wholesome luncheons. Rooms of this sort can be managed entirely by the men, acting through the railroad branch of the Young Men's Christian Association. Of course, there are still other possible ways in which the railroad can help to encourage a higher moral in the men. We are speaking now simply of the one subject of night schools, and without attaching undue importance to this one element. The number of boys who can be brought under such an influence on any one railroad must be a very small percentage of the total employees, but it is an influential percentage. Those boys, as they grow to be men and take positions in the higher grades of employees, and develop into subordinate officers, and finally, the choice ones, into superior officers, will always have an influence far beyond their mere numbers, for they will be leaders of opinion. Coming as they do from the ranks, they will have sympathy for the men and will have their confidence, and in that way will probably, as a rule, be able to exercise more influence among the men than the young men who go into the service from the technical schools. There must be individual exceptions to this, as to all generalizations, but in the main we judge that it will be true.

Finally, even if all our reasoning is wrong, an experiment in this direction is not very costly, and the possibilities of getting valuable results seem so great that we wonder that the experiment is not more often tried. For after all, the workman can never be deprived of the social and political power that he has won. Labor unions can never be suppressed or even "regulated" without the consent of the men themselves. Whether unions are good or whether they are bad is not the question; they are here to stay until the working man finds some better way of getting what he wants. The only hope is in the growth of intelligence in the working man and in the development of courage and independence in the individual. Slowly and by suffering, they will learn that organized society is an affair of compromises, and that the interests and obligation of capital and labor are reciprocal. The final solution of our troubles is education. "For," says Huxley, "education promotes peace by teaching men the realities of life and the obligations which are involved in the very existence of society; it promotes intellectual development, not only by training the individual intellect, but by sifting out from the masses of ordinary or inferior capacities those which are competent to increase the general welfare by occupying higher positions; and lastly, it promotes morality and refinement by teaching men to discipline themselves."

New York and New Jersey Bridge.

Last week the War Deparment gave out a synopsis of the report of the Board of Engineers on the proposed bridge across the Hudson River, and on Sunday the report itself was published in full but for the appendixes.

The daily newspapers have interpreted the synopsis and the report according to their predelictions, many of them saying in their headlines and editorially that a suspension bridge is recommended, as a cantilever bridge would be too expensive, or the more careful say the report seems to indicate a preference on the part of the Board for a suspension bridge. As we read the report the Board says that a cantilever, 2,000 ft., clear span with one pier in the river is safe and practicable; a 3,100 ft. cantilever is impracticable because of the cost; a suspension bridge of 3,100 ft. span is safe and practicable; an adequate 2,000-ft. cantilever bridge can be built for $26,723,000; a suspension bridge of the same capacity can be built for $35,367,671; a lighter, but still adequate, suspension bridge can be built for $30,743,000. These sums do not include track or other fixtures common to both types, nor do they include land, station buildings, terminal structures, the viaduct on the New York side to connect the east end of the bridge with the station, or the connection on the west end, from the anchorage to the several railroads. The estimates include only the foundation and superstructure of the bridge proper, and enough approach viaduct for the cantilever to give it a length equivalent to that of the suspension bridge from anchorage to anchorage. The figures *not given* are vast; the strict limit of the report must be borne in mind in any discussion of its financial bearing.

As we read the report then the Board simply gives three *engineering* solutions of the strict question given to it, which are comparable in the matters of cost and of difficulty of construction.

It distinctly does not say that the either one of the safe and practicable bridges described would be better worth its cost than the other; it distinctly does not say that either of the bridges can earn enough to pay working and maintenance charges and interest on its cost. These are matters on which the Board was not asked to give an opinion. Undoubtedly there were men on the board who believe that the suspension bridge is the best solution; undoubtedly there were others who think a suspension bridge would be a colossal engineering mistake. Perhaps they might have come to agree to recommend absolutely one or the other type; but probably they could not have reached such an agreement in the time given them for this report.

It is true that three or four times as much space is given to the discussion of the possible suspension bridge as to the cantilever; and the headline writer who judges only by the space covered is misled. But the suspension bridge for this work and of this span is much more a matter of doubt than the cantilever; regarding that type the Board had a quite novel study to make; therefore it was obliged by a proper sense of proportion to give more space to the suspension bridge than to the cantilever.

In fact, our criticism of the report is that it does not give enough space to the suspension bridge. Engineers would like to know more of the details of erecting the 50,000 tons of suspended superstructure, it being riveted lattice trusses, 120 feet deep. Of course the Board has considered this carefully; but to us it seems as if this must be a job of the utmost nicety and as if the field riveting would be done under conditions of unparalleled difficulty. Furthermore, it appears as if in making comparative estimates the item of interest account had been neglected to the advantage of the suspension bridge. Before work on the cables can begin the towers and anchorages must be complete. That is, over $22,000,000 must be sunk, to bear the interest during all the time of stringing the cables and erecting the superstructure, and here we get say $1,000,000 a year from interest alone, possibly $5,000,000 in the aggregate. But with the cantilever bridge the erection of the superstructure can begin as each pier is finished, and we should suppose the interest account could be kept much below that of the suspension bridge. Again, we do not understand why, under the conditions used for the lighter and less costly suspension bridge, a lighter and less costly cantilever bridge might not be built.

The Board had fully in mind the unprecedented magnitude of a 3,100 ft. suspended span and the enormous responsibility which would rest upon its designers and constructors; but it also realized that the pier in the river would be an engineering construction of unprecedented magnitude in its class, involving perhaps even greater elements of uncertainty than the immense suspended span contemplated. Therefore when it comes to a question of engineering design and construction it is not possible to draw a sharp line between the two projects and no such line is drawn in the report.

As an engineering paper the report is a document of great interest. No one was ever called upon to seriously study a greater bridge; so able a bridge board can seldom have been got together; therefore we give space to pretty nearly the full text and only regret that we cannot now show sketches of the suspension bridge construction which is discussed.

Taking the report as it is we conjecture that the Secretary of War will give the bridge company a chance to raise the money to build a suspension bridge first. If that fails the scheme will have to revert to the cantilever project. Now the least expensive suspension bridge is estimated to cost $4,000,000 more than a 2,000 ft. cantilever bridge even with the $9,700,000 pier, and $4,000,000 is really a great deal more money than $26,700,000 when you come to try to raise it. In fact it is 15 per cent. more and it makes the difficulty of financing the scheme at least that much greater; but these figures include the cost of the bridge only. To this must be added the cost of land and terminal structures, of track and viaducts; let us say at a guess $20,000,000 more, making an aggregate of say 47 millions of dollars for the cheapest bridge and four millions more is only 8½ per cent. of this aggregate; so that after all perhaps the suspension bridge can be financed if anything can be. Just now, however, this discussion seems rather academic, for we should suppose that there would be little chance of raising the money for either bridge for a good while to come. But the patriotic

citizens who have been so anxious to preserve the Hudson waterway unimpaired, and those who have been so solicitious about the aesthetics of the new bridge may now have a chance to subscribe an additional $4,000,000 or so to get a 3,100 ft. suspension bridge.

There is another matter to be considered in speculating as to the possibilities of this great enterprise, and that is the position into which the last Act of Congress has forced the New York Central Railroad. The engineers of the bridge company located the bridge at about Seventy-second street on the New York side, which kept it clear of the New York Central's property, and this location excited no hostility from that company. The last Act of Congress, at the instigation of property owners above Seventy-second street, required that the location should be made between Fifty-ninth and Sixty-ninth streets the result of which would be to bring the New York pier of the bridge directly in front of the very valuable dock property of the New York Central Railroad, and of course such a destruction of the franchises of this company will be resisted strenuously and the New York Central Co. is a hard company to fight when it is wrong and still harder when it is right. So even if the present bridge company accepts the suspension bridge plan, which we assume the Secretary of War will favor, and it finds that the money to build that bridge can be raised, there will still remain the necessity of settling with the great corporation which owns the property on the New York front where the New York pier must be built.

This time it is the Lucania which has made a new westward record. Her time from Daunt's Rock to Sandy Hook was 5 days, 8 hours and 35 minutes, and she passed the lightship at 4.58 Friday afternoon, Aug. 31. Her daily runs were 525, 555, 527, 530, 541 and 111 knots, the total run being 2,789. She had made a better single day's run on a former voyage, namely, 565 knots. She had also exceeded the average hourly speed, and this last quick trip was due partly to the short route. It will be remembered that the Campania lowered the westward record two weeks before to 5 days, 9 hours, and 29 minutes, also landing her passengers on Friday night. The most important fact about these new records is that they just pass the line where the saving of a very little time in the trip saves the passengers 12 hours, more or less, in landing in New York, for it brings them to Quarantine in time to pass and get up to the dock and unload their passengers instead of keeping them in the lower bay all night. In this particular the new records are like the lowering of the time between New York and Chicago from 25 hours to 20.. Above 25 hours a few hours more or less made no great difference in the time gained, for the man leaving New York one afternoon would not get into Chicago in time to do any business the next day, so he might as well spend another night on the train as in a Chicago hotel so far as ordinary business affairs went; but when the time was suddenly reduced to 20 hours he was enabled to do business in New York one day and in Chicago the next. Unfortunately, perhaps, the 20-hour trains were discontinued after the close of the World's Fair, but the possibility of running them has been established. The standard is fixed which will probably be worked up to as prosperity returns. The two new Cunarders have similarly passed a point where a definite advantage is got by a little higher sustained speed, and so have fixed a standard to which the ocean steamers must gradually work. The Campania also made a new record last week in the eastbound trip. Sailing from New York at 1:50 p. m., Aug. 25, she made the voyage to Daunt's Rock in 5 days, 10 hours and 47 minutes, beating her own previous record by 1 hour and 13 minutes.

The United States torpedo boat Ericsson has reached New London, Conn., after her voyage of 3,500 miles from Dubuque, Ia., down the Mississippi River, through the Gulf, up the Atlantic Coast to New York and through Long Island Sound. She was built at the yards of the Iowa Iron Works at Dubuque, on the Upper Mississippi, and started on her journey to sea Aug. 8. The fact that a craft of this class could be built so far inland gives some notion of the war resources of the country, and the prodigious journey that she made from the yard of the builder to the place of her sea trial, gives some notion of the latitude and longitude of the nation which owns her. It appears that for the run down the Mississippi special screws were put on as the river was low and many snags were sure to be encountered. When she was docked at New Orleans it was found that the blades of her screws were pretty nearly cleaned off; there the bronze screws were put on. She worked her way by inland waters through a part of Florida and from Savannah to Charleston, and made the trip from Charleston to New York in the open sea. The craft is 150 ft. long, 15½ ft. beam, draft, 4¾ ft., normal displacement, 150 tons, estimated speed, 24 knots. She has a fixed launching tube in the bow for the Howell torpedo, and two movable tubes on a training circle aft for the Whitehead torpedo, and four one-pounder rapid firing guns. She has two vertical inverted, direct-acting, quadruple-expansion engines, and boilers calculated for a working pressure of 250 lbs. One of the New York papers, in announcing her arrival, does it under the headline "She is full of Fight." We suppose the headline editor had in mind James Whitcomb Riley's tribute to his old shot gun, "She's as full of tribilation as a yaller jacket's nest."

A press dispatch informs us that "the Co-operative Rolling mill Co., which was organized several months ago to operate an idle mill at Hubbard, Ohio, has declared its first dividend. The amount is 1 per cent. All the employees of the mill, except the bookkeeper, have left 50 per cent. of their earnings in the general fund of the institution since it was started, and they are not at all satisfied with the amount received." Well, what's the matter? Why are they dissatisfied, and with whom? Perhaps it is the bookkeeper. Abolish bookkeepers; count the cash every night and divide it equally; divide everybody's property; down with capital; Vive Gompers and Debs! That's the way to run society. What's the use of capital any way? Does not labor create all values?

NEW PUBLICATIONS.

Anuario de Ferrocarriles Espanoles. (Annual of Spanish Railroads.) Edited by Don Enrique de la Torre. Madrid: 1894. Price, 3 pessetas.

This is the second annual volume of an excellent manual of Spanish railroads, undertaken as a private enterprise, and bearing slight evidence of the influence of Poor's Manual in its general arrangement. Incidentally it gives much information concerning the economic conditions of Spain, and matters relating to the movement and distribution of articles of commerce in that country.

The first railroad construction in Spain was commenced in 1848, on the line from Barcelona to Mataró, but the first road opened to service was one from Madrid to Aranjuez, in 1851. The early concessions were granted in perpetuity, but these were revoked later, and the plan of the reversion of the roads to the state after some fixed time was substituted. Although there are now 6,936 miles of railroad in Spain, the era of railroad development has scarcely begun. In 1893 there were opened 405 miles of new track, and 14 new concessions were granted. Owing to the inability of railroad managers to appreciate the importance of such a statistical annual as Señor de la Torre has undertaken to publish, it was found impossible to procure data from all the Spanish lines, but the reports covering 5,921 miles show a gross return for the year of 191,781,482 pesetas (the peseta ranging in value from 19 cents to 22 cents). Of this amount 57,922,767 pessetas was derived from passenger traffic. The working expenses amounted to 86,125,000 pesetas, being a little over 45 per cent. The passenger movement reached a total of 26,864,260, averaging 74,625 per diem, and 2,813 per kilometer during the year.

A comparison of passenger rates in Spain with those of other countries shows that Spain stands on a par with Germany in the first and second class, while the rate for third class is 4½ centimes per kilometer in Spain against 5 centimes in Germany. The first-class rate in England is a trifle less than in Spain, but the second and third class rates, as well as the average of all, are higher. It is noteworthy that the percentage of first-class passengers is higher in Spain than in any other European country, being followed in order, in this particular, by France, Holland and Italy.

An analysis of the returns from each road is given in detail, together with the personel of the companies, with addresses. The railroad laws are given by abstract, as also the regulations governing the operation of the roads, the handling of traffic, and tariffs. An index of all stations, referring to tables in which distances are given, forms a valuable feature of the work. There is also a map showing all the lines in Spain now open, those in construction, and projected.

A Dictionary of Electrical Words, Terms and Phrases. By Edwin J. Houston. Third edition with Appendix. New York: The W. J. Johnston Co., 1894. Price $5.

Prof. Houston's dictionary has reached a third edition although it was but a very few years ago that the necessity for such a dictionary was even suspected, and only five years ago the first edition was published, so wonderful has been the growth of the electrical science and art. The dictionary is designed as an encyclopedic dictionary of electrical practice. The third edition, which now appears, is said to contain about 20 per cent. more matter than the second, but this matter appears to have been collected in an appendix rather than incorporated in the body of the work. Doubtless this was a sensible thing to do, as it saved mutilating the plates and saved a serious expense in composition; but of course it makes the work slightly less convenient for reference. The appendix does not by any means consist entirely of words which might have appeared in the second edition, for many of the words and terms are new or at least have been established in use since that edition was published. The work of the International Electrical Congress of the World's Fair and of the Committee on Units and Standards of the American Institute of Electrical Engineers, made necessary the revision of the dictionary as has the ever widening development of the uses of electricity. We are informed that the dictionary includes upwards of 6,000 distinct words, terms or phrases, and 582 illustrations. Its usefulness is greatly increased by the copious cross references.

Transactions of the American Institute of Mining Engineers. Volumes XXII, and XXIII. Office of the Secretary, 13 Burling Slip; 1894.

In these two stout volumes, aggregating nearly 1,500 pages, are collected the proceedings, papers and discussions of the Chicago meeting of 1893, constituting Divisions C and D of the International Engineering Congress. These divisions were those of mining and metallurgy. Still further discussions will be published in volume XXIV, but we understand that *the papers* are complete in these two volumes. Of course they contain a great amount of valuable material, and the volumes are indexed and printed with the care to which we are accustomed in the publications of the Institute.

TRADE CATALOGUES.

Three Position Signals.—The Eclipse Co., Beaver Falls, Pa.

The Switch and Signal Department of the Eclipse Co., has just issued a catalogue showing some specialties. The most important of these is a semaphore signal for block or train order purposes. It has three positions, horizontal or red light for danger, inclined or green light for caution and vertical or white light for safety. In the vertical position the signal blade hangs clear of the post so that it is quite as positive a signal as in its horizontal position. Moreover, the colored glasses are so arranged as to get little jar in the movement of the blades, lessening the liability to breakage, and the company claims that the movement of the blades cannot be obstructed by ice or snow. Further, the operating levers are connected by electrical contact to a bell in the cabin so that when the signal is pulled clear the bell will ring, thus warning the operator.

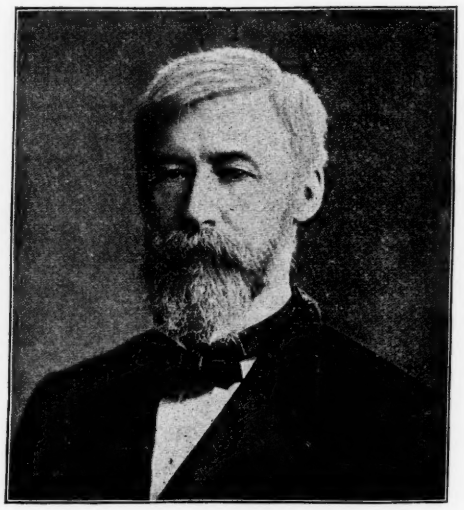
The company advertises a hollow steel pole, so arranged that the lamp can be hauled up inside, and it is unnecessary to climb the pole to fix the lamp. It advertises also a new switch stand very simple and compact, and a mechanical connection from the switch points to the signal so that the signal shows the position of the points themselves and not of the switch stand.

The Phosphor Bronze Smelting Co.—Philadelphia, Pa., issues its 1894 Price List, No. 9.

John Newell.

Last week we briefly announced the death of Mr. John Newell and gave a short account of the many official positions which he had occupied; it is now intended to give a brief estimate of his character, as we then promised. He was an imperial man; his virtues, his accomplishments and his failings all resulted directly from this fact. At the age of seventeen or eighteen, he was assistant engineer in charge of the construction of an important section of the Vermont Central Railroad, and began the exercise of supreme authority; and from that time until his death he occupied positions which made him commander-in-chief, or nearly such.

He was never without a purpose, and he directed his forces towards its accomplishment by a very short,



John Newell.
Late President of the Lake Shore & Michigan Southern Railway.

straight course, seldom telling what was the end in view or giving any explanation of his orders; so that often his instructions appeared to his subordinates wilful or perhaps unreasonable, until the event revealed the completed campaign. This reticence did not seem to be from design on his part, but to result from a disinclination to reveal himself which he found very difficult to overcome, and which no doubt caused him some private regrets; for although on the exterior what we call a hard man, many of his charities and generous acts of forbearance and of forgiveness of personal injuries betrayed a core of tenderness within. If the wife or the family of an old comrade were left in want, he did not communicate with them, but would ask a near friend to give them his liberal donation; he met an acquaintance in sudden trouble and in the most embarrassed manner pressed a roll of money into his hand, saying as he hurried away, "This will do you more good than it will me." Many who spoke ill of him or who openly judged him harshly, he retained for years in the service, content if they did their duty towards the company; many such who were discharged for cause, he gave places to upon reformation; and so often did this happen as to indicate complete indifference to the opinion of others of himself.

It was not at all likely that he was ignorant of these

opinions, for Mr. Newell was one of those observers who saw everything. If he could be got to talk about his trips abroad, as he sometimes could, it was astonishing how much he had seen in passing through, which had escaped the notice of one who had been longer in the country described. On his railroad he knew every important farm or mill, and its condition this year as compared with previous years. He liked to have people of wit or intelligence in his car and listened to them with evident enjoyment, but seldom told a story or made a joke himself. Probably in his whole life he never made a remark which would detract from the reputation of another. If any one did so in his presence, he might raise his eyebrows and smile, but he would not utter an assent.

It is scarcely necessary to mention Mr. Newell's great achievement in the perfection of the alignment and grades of the Lake Shore & Michigan Southern Railway out of its earnings, in this notice of his character, for it is worthy of a detailed description and of a permanent place in the literature of engineering.

Allusion has been made, in some of the notices of Mr. Newell in other journals, to his services to the Illinois Central Railroad after the great fire in 1871. But his most characteristic action at that time has not been told. He reached Chicago on Monday morning after his home had been burned; he saw the flames threatening to destroy the remaining elevator of his road, upon which its earnings for the next year must depend; he noticed upon a flat car in the freight yard a steam fire-engine on the way from the manufactory to some distant city. Without a moment's delay he had the fire-engine brought to the rescue, found out men who could put it into condition for use, and by its help saved the elevator from destruction. After 9 o'clock that night, black with smoke and with clothing almost in rags, he came to the south part of the city to ask where his family had gone.

A remarkably restless activity was probably the cause of the early conclusion of Mr. Newell's career, for the very best steel tire can run with safety only a limited number of miles; let it be tempered as it may, it can be worn out. Railroad men are proverbial for overwork; we expect, almost as a matter of course, that a general manager will suffer, after a while, from nervous prostration or from a lesion of the brain. It has been wonderful to those who knew of Mr. Newell's ceaseless exertions, that he did not yield to their effect. Although very temperate in diet, careful about his sleep, walking much for exercise, it was evident to all, except to himself, that he ought to work less and to rest more.

In reading and in art he found some relaxation for the mind; he was fond of books of facts, biographies and travels; he admired good pictures and bought them with an independent judgment, not because the names of the artists were famous, but because the pictures were pleasant to him; they were chiefly of homelike scenes. His home, with amiable wife and children and petted grandchildren, seemed this strong man's only delight. It was only there that he was completely revealed and understood.

James Nelson Lauder.

The death of James Nelson Lauder calls for more than a passing notice, and although there are many who might with more propriety speak of his many excellent qualities, still the writer has enjoyed peculiar opportunities during an intimate acquaintance of fifteen years to know him thoroughly.

Mr. Lauder was a natural leader among men. This began many years ago. When well within his teens he was made gang foreman, and soon after foreman of a machine shop, and later master mechanic of the Northern Railroad. It was also shown by his being chief of the Concord, N. H., fire department, where, by many outside of the department he was often spoken of as "the chief," much to his amusement. It was furthermore shown by his always being the center of a group, whether at the United States Hotel, Boston, where he boarded twelve years, or when looking after his business, or upon the verandas of hotels at which the Master Mechanics' conventions were held. On these last occasions, the group of which Mr. Lauder was the center was always conspicuous. This was due to his strong personality and magnetism, his commanding presence, a considerable fund of information, an easy facility of speech, and to his keen sense of humor. Moreover, he had travelled a great deal in this country.

At the Master Mechanics' conventions nobody was listened to more attentively than Lauder, and although belonging to the "old school" nobody will be missed as much as he. He always spoke to the point, was emphatic and clear, had convictions, and, withal, possessed the admirable quality of stating them fearlessly. In fact, his courage was conspicuous and well-recognized. It was often turned to good account, and was of great value in protecting the Association from degraded membrship.

One of Mr. Lauder's peculiarities was his dislike of humbugs, and the word "device" was disagreeable to him. On account of his strong dislikes and his fearlessness of expression he created enmities among people who urged upon him the adoption of "devices." On the other hand, his strong likes created strong friendships, and a man who could claim Lauder as a friend, possessed a friend indeed.

To his associates and subordinates he exhibited always a most kindly spirit. He was a very reasonable man, and would listen to explanations, when there was doubt, with great patience, and entirely dispossess himself of prejudice. While in a general way he possessed prejudices, he was always conscious of it, and was remarkable for clearing himself of it. This is one of the strongest and best qualities that a man can possess. Furthermore, it can be truly said that Mr. Lauder was an honest man.

Concerning Mr. Lauder's professional career, he was always intensely interested in his work, and gave to it a great deal of discerning and well-directed thought. Many years ago, on the Northern Railroad, he studied the link motion and steam distribution by means of models and the indicator. He applied himself with industry to eliminate the defects of the link-motion, and succeeded to a great extent. A peculiar feature of his locomotive design, always noted, was the location of the rocker in front of the guide yoke, the value of which his investigation had shown in reducing lead and compression at short cut-offs by means of the long eccentric rods which it permitted.

While he did not fully realize the extent to which condensation is the enemy of economy, and the lightning rapidity with which iron absorbs and gives up heat, he appreciated it sufficiently to take unusual precautions to prevent loss of efficiency from this cause.

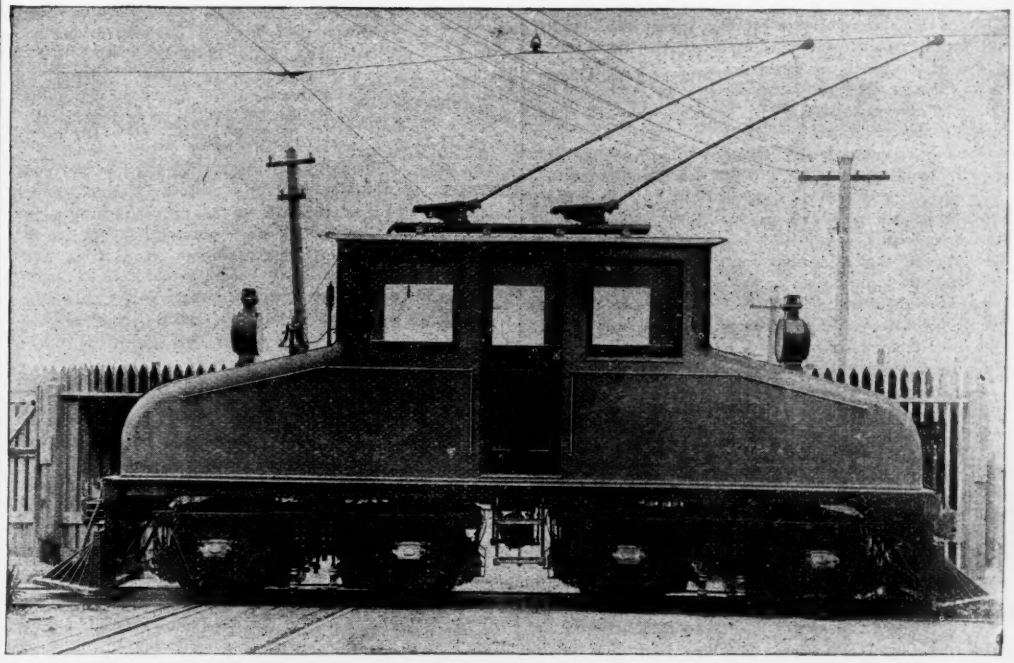
The steam distribution in Mr. Lauder's engines was accomplished in a most ideal manner, considering they were locomotives, and while his "standard locomotive" was designed at a time when there was nothing but ordinary speed, it now draws the fastest trains over the Shore Line between Boston and New London with great satisfaction.

Passing away as he did, at an age (57 years) which is far from old, not beyond the prime of life, and after a life free from ills and full of vigor, Mr. Lauder's death is particularly sad and unrealizable.

F. W. DEAN.

A Forty-Ton Electric Locomotive.

The General Electric Company has recently completed a 40-ton electric locomotive which is now in the factory yard at Lynn. It is designed to do the ordinary work of a steam locomotive where high speeds are not requisite; say up to 30 miles an hour. It has two four-wheel trucks, each pair of wheels being driven by its own motor, the motors being single reduction, spur-geared and mounted on the axles. The truck frame is of plates and channels, strong and simple, and the entire weight is carried on eliptical springs resting on the journal boxes. The journal boxes are of cast iron with phosphor bronze bearings, with ample lubrication. The boxes slide in jaws with adjustible shoes for wear. The cab is of sheet iron and the windows in it are so arranged as to give an almost unobstructed view in all directions from one position. The general outline of the whole machine is symmetrical and is that which has become familiar from many earlier illustrations of the few similar engines that have been designed. The electrical equipment comprises, besides the motors, a series parallel controller, and air compressor, which provides air for the brakes and whistles, and the automatic safety devices. In addition there are bells, head lights and sand boxes.



A 40-ton Electric Locomotive.

The dimensions are as follows:

Weight	40 tons.
Draw bar-pull	14,000 lbs.
Height over all	11 ft. 2 in.
Length over draw bars	24 ft.
Width over all	8 ft. 4 in.
Wheel base of single truck	6 ft
Diameter of drivers with 3-inch steel tires	40 ins.
Number of drivers	8
Size of journals	4½ ft. 8 in.
Gage	4 ft. 8½ in.

The Training of Railroad Officers.

In England, as in the United States, the railroad officer *grows*, according to no preconceived theory or arrangement. The humblest person may hope, in either country, to rise to the highest grade, and promotion is much less a matter of favor than is generally supposed, and much more a matter of merit. Doubtless the American and the English railroads are worked with greater enteprise and efficiency, and possibly with greater economy, than the systems of any other country, taking them altogether. And yet we often hear the idea expressed that there should be in each of those countries some systematic method of training men for the various grades or railroad service, and possibly it will be of interest both to American and to English readers of the *Railroad Gazette* to know something of the highly systematized method followed on the state railroads of Prussia.

There, in addition to plate-layers and other laborers, there are three separate classes of officials, and it is quite an exception either for a member of the lowest class to rise to the middle class, or for an official of the middle class to attain one of the highest positions. The officials of the lowest class perform in-door duty as clerks and draughtsmen and out-door duty as station agents, train conductors, etc. Their pay ranges from about $350 to about $500, according to length of service. They are drawn, whenever practicable, from the ranks of time-expired soldiers, but sometimes they are promoted from the laborers' class. Before entering the railroad service on probation they have to pass a preliminary examination in general knowledge, and before obtaining a definite appointment a second examination is necessary on the duties of the special branch of service to which each man is assigned.

The officials of the middle class perform out-door duty of the higher order in the traffic department [An American would call it the transportation department. —EDITOR.], and also fill the positions of clerks and sub-managers in the general offices. Their pay starts at $450 per annum and can rise to about $1,350. They are partly-time expired soldiers and partly civilians who have received a sound education in the grammar schools. Before being appointed railroad officials they have to pass an examination in general knowledge, and those anxious to advance to the highest posts in this class have subsequently to undergo a second examination in railroad work. The highest position for which officials of the middle class are eligible is that of traffic superintendent. [Our superintendent of transportation or general superintendent.—EDITOR.] Of these officers there is one to each of the eleven directions or districts of the Prussian railroads, and the men who have worked their way up to these posts rank both in pay and station with the officials of the highest class.

With this exception, however, all positions of the first class in the Prussian railroad service, such as those of general managers, comptrollers, general road masters, superintendents of motive power, and the like, are filled up from a special class of officials, men of good social status and education, who have gone through a long and theoretically complete course of training in preparation for their future duties. Such men, after completing a course of three years university study, devote themselves either to the general civil service (of which, of course, under a *régime* of State control, railroad employment forms a part) or to the profession of lawyer or engineer. Those who at once enter the civil serivce, having first passed a government examination, become legal assistants (*Gerichts Referendar*) in which capacity, they work for two years in the law courts. After this they undergo a further course of two years on the provincial government systems in the capacity of government assistants (*Regierungs Referendar*). A second government examination then takes place, successful candidates in which are appointed higher government assistants. Should they then wish to enter the railroad service they have to undergo one year's probation, during which they pass through every branch of railroad work. After this they are eligible for permanent appointment as railroad officials of the highest rank.

Lawyers are eligible for railroad service who have undergone four years training in the law courts and have then passed the examination qualifying them as higher assistants to the law courts. These also have to serve one year probation in all branches of railroad work before being definitely appointed higher railroad officers.

As for the engineers, these must study for four years at the Polytechnicum which ranks with the universities, during which time they must pass a preliminary examination in general science. They have then to pass the

first government examination to become government inspectors of works (*Regierungs Baufuehrer*). In this capacity they serve for three years either, under the general administration of works or under the railroad administration, at the end of which they must pass the second government examination either as engineers of works or as mechanical engineers. Then they are eligible for appointment as higher railroad officials with or without probation, according to what experience they have already had of railroad work. Should they wish, however, to enter any department of the service except the engineering department, they have first to spend six months in gaining a general knowledge of the railroad system.

The pay of Prussian higher railroad officials is on a graduated scale, commencing at about $1,050. The maximum pay is $9,000 with a house free of rent, which is also the ordinary remuneration of a Prussian Minister of the Crown,. The average pay is thus small, but considerable social status attaches to the position of higher railroad officials in Germany.

By the method above described Prussia obtains for its higher railroad service a class of men of good breeding and social status, well educated and versed in affairs, and who at the same time have acquired a good all-round preliminary knowledge of railroad construction and working. The last item, however, would seem to be the weakest part of the system, for the knowledge which a man can acquire in "one year's preparation service, during which he passes through all branches of railroad work," cannot be very complete or very serviceable in practice. On the other hand the man who in the service of an American or English railroad has worked his way up to a high position through various grades of duty, is sure to have acquired a stock of knowledge and experience, which, if far from complete theoretically, is every bit of it of service in meeting the calls made upon it. Herein lies the strength of the more democratic method of railroad administration, and it has this other important advantage that it offers an inspiring prospect of promotion to every official, and avails itself of ability and industry manifesting itself in the humblest quarters. If it had been impossible for men to rise to high posts from the lowest ranks of the service, American and English railroads would have lost many of their most able and celebrated administrators.

On the other hand breeding and education count for a good deal even in business enterprises, and unless these are cultivated the personnel and calibre of railroad officials must inevitably deteriorate. A large proportion of the men who in the past have worked their way up to become general managers, superintendents and even presidents, began their railroad career as clerks; but in their early days a man fit to be a clerk was *ipso facto* something better than many of his fellows. But in these days of universal schooling, clerical work presents few difficulties, even to the least educated. Consequently many of these who enter the lower ranks of railroad service are of a lower calibre than was the case a generation ago. Amongst English railroad managers it is a matter of common remark that when a man is wanted for a responsible position, the difficulty often is, not to select one out of many possible appointments, but to find a single candidate who is thoroughly suitable for the work.

The reason is that most of the officials enter the service as boys, primed only with that smattering of learning which they acquire at the public day schools.

They are immediately put on some routine work, which hardly varies perhaps for five or even for ten years, and they come through the mill with all their grit and ambition knocked out of them. There are so many low positions in railroad service and so few high ones that it is difficult to see how men could be specially educated for the latter without making these, as they are in Germany, "close" appointments and so doing away with that open prospect of possible promotion, to the value of which, as an incentive to industry, we have already referred. But the defect of our present system is that it is fast ceasing to attract men of breeding and good education, and that it gives men of ability who rise few opportunities of gaining that all-round knowledge of railroad operations which they need to properly fill the highest positions. C. H. G.

LONDON, August 17.

TECHNICAL.

Manufacturing and Business.

The Whitney Foundry Equipment Co. has shipped from its new plant at Harvey, Ill., a No. 1 cupola for the Griffin Wheel Co., at Chicago, and No. 3 cupolas have been built for the Escanaba Iron Works in Michigan and Snow and Williams, of Delphos, O.

The Pennsylvania Steel Co.'s plant at Steelton, Pa., is at work upon large orders for the Philadelphia Traction Co. and the Bridgeport, Conn., Electric Co. A night turn of 150 men has been added to the force in the bridge and construction department.

The Eppinger & Russell Co., of Long Island City, was incorporated in New York last week to conduct creosoting works and saw mills in Florida and New York. The capital is $100,000, and the directors are Isaac Eppinger, Austin B. Fletcher, Isaac D. Fletcher, John W. Chapman and Jessie Eppinger, of New York City.

A meeting of the stockholders of the Michigan Peninsula Car Co. is to be held at 184 La Salle street, Chicago, on Oct. 2 for the election of directors. The company has just passed another semi-annual dividend. The Ferry street branch shops in Detroit, which recently opened after a year's idleness, have again been shut down. The West Detroit plant is also likely to be closed as soon as the present orders have been completed.

The Whitely Malleable Casting Company, of Muncie, Ind., has recently started its plant, employing about 150 men. This number, it is expected, will be steadily increased to 500 men. Besides malleable castings, the company will also make a full line of grey iron and brass work. In these lines the company will be prepared to make anything that is offered and in any quantity. The plant is provided throughout with electrical equipment.

The New York Dredging Co. is calling particular attention to the fact that it has some special machinery for the reclamation of low land by filling, and at the same time deepening the adjacent water front. All the work of excavation and conveyance is done at one time, and at one operation, by a single machine. The machine is also adapted for dredging and canal work. The company has invested one-half million dollars in its plants, which can be made available at different points in the United States, and has recently executed work at Oakland, Cal.; Honolulu, Hawiian Islands; Boston, Mass.; Jacksonville, Fla.: and Washington, D. C.

The Garlock Packing Co. is able to make a report which few manufacturing companies have done this year, its business in 1893, its officers state, being nearly twice as large as that in the previous year. O. J. Garlock, E. Nichols and F. W. Griffith have constituted the firm since its organization as a company in 1887. The packing manufactured by the company is the invention of O. J. Garlock, a practical engineer of many years' experience. The company now manufactures its goods at Palmyra, N. Y., and Rome, Ga., and has warerooms in New York, Chicago, Omaha and other cities.

The Bucyrus Steam Shovel & Dredge Co. has received an order from the McArthur Bros. Co., at Chicago, to duplicate the steam shovel built for that firm some time ago, which was the largest and most powerful steam shovel ever built. E. D. Smith & Co., Wilson & Jackson and other large contractors have recently placed orders with this firm. Its works at South Milwaukee, Wis., are now running full time with a full force, and the company believes that the prospects for a large Fall and Winter business are very good.

Iron and Steel.

The fine new rolling mill of the Chicago Forge & Bolt Co., just rebuilt, is offered for sale or will be leased. This plant has been built entirely of iron and brick and is located at Fortieth street and Stewart avenue Chicago, having excellent railroad facilities and with plenty of ground for future enlargements. It is equipped with ten 18-inch trains and has a capacity of 75 tons of finished products a day.

The Lukens Iron Co., of Coatesville, Pa., has received an order for 1,000 tons of ship plates and boiler plates from Harlan & Hollingsworth, of Wilmington, Del., for one ship building at that firm's yards.

The Birmingham Rolling Mill and the Gates City Rolling Mill at Birmingham, Ala., were started up on September 2, employing together about 1,200 men. Both plants have been idle a number of months but improvements costing about $150,000 have been made during that time. The furnaces at Sheffield and Florence, Ala., are also preparing to start up.

The Pennsylvania Iron & Steel Co. has been incorporated in the State of Washington by L. S. Morrison, George R. Fisher and others. The plant is to be located at Edmonds, in Snohomish County, Washington.

The old directors of the Pittsburgh Forge & Iron Co. were re-elected at the recent annual meeting at Pittsburgh. Calvin Wells was elected President and F. E. Richardson, Secretary. The annual report made a favorable showing of the company's affairs.

Nearly 100 tons of forgings for 10 and 12-inch guns have been recently shipped from the ordnance works of the Bethlehem Iron Co., Bethlehem, Pa., to the Watervliet arsenal at Troy, N. Y.

The William Swindell & Bro. Co. of Pittsburgh, has just completed a new steel foundry for the New York Frog Switch Co., of Hoboken, N. Y. The furnace includes a 7-ton open hearth, annealing furnaces, core ovens, etc.

The Illinois Steel Co., will start up its rod department at Joliet, Ill., which has been closed for three months, next week under a new scale of wages, which is from 15 to 20 per cent. lower than the old scale.

Car Heating.

The Gold Car Heating Co. has contracts from the Pittsburgh & Western to equip the entire passenger cars of that company with its steam-heating appliances which will be standard upon the road. Pennsylvania has now a law requiring the railroads in the State to equip their cars with steam heating-devices, and the Pittsburgh & Western is one of the few railroads which have adopted that improvement, without being brought to such action, in order to comply with the terms of a car heating law.

THE SCRAP HEAP.

Notes.

The Pittsburgh, Shenango & Lake Erie has restored the wages of its employees to the basis existing Jan. 1 last, when a reduction of 10 per cent. was made.

The shops of the Northern Pacific at Brainerd, Minn., have resumed work with over 400 men after being idle since last July. The West Shore shops at Frankfort and other points, which have been running on eight hours' time are to make 10 hours a day hereafter.

Two passenger trains on the Lake Shore railroad standing in the Union Station at Erie, Pa., were entered on Aug. 28 by five tramps, and considerable money secured from the passengers. They escaped from the station, but were afterwards captured before they could get out of the city.

The through dining-car service on the Union Pacific line to Portland over the Oregon Railway & Navigation Co.'s road has been abandoned. The dining car will continue to run on the Union Pacific to Ogden, but the Oregon Railway & Navigation Co. refuses to haul the car west of that point.

The dry weather in Eastern Pennsylvania is beginning to cause the railroads some trouble. The Wilkesbarre & Western is said to have taken off many of its coal trains temporarily because it could not obtain water for its locomotive water tanks. The Lehigh Valley & Hudson, have also experienced some inconvenience.

Receiver Trumbull, of the Denver, Leadville & Gunnison the South Fork railroad, has issued a circular notice that hereafter no free transportation will be issued by him over that road. He gives as a reason that the business of the company has for several years shown a large deficit and to reduce this it is necessary to restrict absolutely the issue of passes.

Grand Master Sargent, of the Brotherhood of Locomotive Engineers, in his report to the Brotherhood, which is to be read at the convention at Harrisburg, Pa., on Sept. 10, notes a falling off in the membership of 4,000 in the past two years. The total is now about 25,000. During the last fiscal year $433,500 was paid out by the order on account of its life insurance feature, this sum representing 89 in claims of $1,500 each.

Defining the Jurisdiction of Certain Officers.

The new Southern Railway Company has issued circulars, extending the jurisdiction of the heads of the motive power and engineering departments on the Eastern Division, formerly the Richmond & Danville, over the entire system, and defining the duties of those officers. We copy the essential parts of the circulars:

The Superintendent of Motive Power [Mr. R. D. Wade] will be assisted by an Assistant Superintendent of Motive Power, [Mr. W. H. Thomas], with office at Washington, D. C. The Assistant Superintendent of Motive Power and master mechanics will report to and receive their instructions from the Superintendent of Motive Power. Road foremen of engines and engineers and firemen will be under the control and supervision of the Superintendent of Motive Power and will report to him through the master mechanics in all matters relative to the condition of locomotives; but in all matters pertaining to the discipline while on the road they will be under the direction and control of the superintendents, who will have full authority to suspend or discharge engineers or firemen. Engineers and firemen will be appointed by the Superintendent of Motive Power through his assistants, but no engineer or fireman shall be appointed until he has passed an examination on the rules and regulations by the superintendent or his representative and received a certificate of competency from him. The Superintendent of Motive Power will have general supervision of all machinery, shops, engine houses, car sheds, and of all employees engaged in the work of constructing, renewing or repairing rolling stock. He will assign engines to the different divisions, and change such assignment from time to time as may be necessary. He will prepare and issue plans for standard locomotives and cars of different classes, and standards for all details for repairs, which must be strictly adhered to. The Superintendent of Motive Power will report to the Third Vice-President.

All plans and specifications for bridges, buildings and other structures will be prepared in the office of the Chief Engineer [Mr. Channing M. Bolton], and when approved will be furnished the General Managers for their use. He will supervise the shop construction of all bridges and metal structures and make the necessary inspection of bridges and trestles. No changes shall be made from the approved standards furnished by the Chief Engineer in the character or form of materials or devices used in the construction and maintenance of the roadway. The Chief Engineer shall keep record of all changes in existing tracks and of the location of new tracks. He shall have charge of all right-of-way matters and keep copies and proper records of all deeds and other important papers relating to the right-of-way. All original maps and profiles and the plans of all structures shall be in his custody. All officers requiring information on right of-way matters will apply to the Chief Engineer, who will furnish copies of deeds or give such information as may be needed. The Chief Engineer will report to the Third Vice-President.

A Steamship Line to Liberia.

The African Steamship Co. has been chartered in the State of New Jersey. Its capital stock is $300,000, of which one-half is said to be already subscribed and its purpose is to trade between Philadelphia and Liberia. Its vessels will carry the mails and will have a subsidy of $10,000 a year from the Liberian government.

A Short Railroad with a History of Changes.

The Tonawanda Valley Railroad will hereafter be known as the Buffalo, Attica & Arcade Railroad. No other road in the State has had so many titles as this road. It was built in 1853 and called the Attica & Arcade Railroad; then its name was changed to the Attica & Alleghany Railroad and later on, in 1872, it became the Tonawanda Valley Railroad. Afterwards it was known as the Attica & Freedom Railroad and now its present name. At first it was built as a standard gage road, and in 1870 it was made narrow gage. At present it is being altered to the

standard gage. New rails and ties are being used and new bridges will be erected.—*Buffalo Paper.*

The Traveling Engineers' Association.

The second annual convention of the Traveling Engineers' Association will be held in Denver, convening Tuesday, Sept. 11, and continuing three days. This association was organized two years ago, for the mutual benefit of the traveling engineers of the country, and as its motto indicates, "To improve the Locomotive Engine Service of American Railroads." It has shown itself to be one of the valuable associations of railroad men and has come to be recognized as one of those deserving of encouragement. The following topics are to be reported upon and discussed at the coming convention:

True and false economy in caring for and the safe handling of the air-brake under all conditions; and when examining a fireman for promotion, how much knowledge of the air-brake is it necessary for him to have to be considered fully competent to take a train out on the road.

What are the best means of saving coal and increasing or holding the mileage per ton at a desirable figure?

Testing coal in actual service; what are the easiest and most accurate methods?

What relation does a clean engine bear to the economical use of oil and supplies?

How can traveling engineers improve the service when engines are double crewed or pooled?

On a uniform form of examination for firemen for promotion and new men for employment.

The headquarters of the Association during the convention will be at Hotel Albany.

A Channel in Lake St. Louis.

The Dominion Government has decided to make a channel in Lake St. Louis, starting at Lachine wharf, of a depth of 16 ft., with a proportionate width, until deep water is reached. This will enable steamers for points along the lake to avoid the great circuit now necessary. The estimated cost of the work is $300,000.

Economy of Barges on the Lakes.

The action of the Minnesota Steamship Co. in giving a contract to the Chicago Ship Building Co. for two steel tow barges, to be engaged with its steamers in the ore trade, has again directed attention to the question of economy in tows as against fast running steamers. There are various conditions to be taken into account in considering this problem, especially in the lake trade, where delay in port with a vessel of any kind is to be avoided at all times. The Minnesota company, with its large fleet of steamers to care for the barges, and with shore connections that insure dispatch, is in a position to reach some important conclusions in this matter, and it is evident from the equipment to be given to the barges that the trial of them will be under the best conditions.—*Marine Review.*

Canada's New Mail Steamers.

The Canadian scheme for a 20-knot weekly mail service to and from Great Britain, provides, according to the recent act of Parliament, a subsidy of $750,000 to be given for ten years, after which it is to be reduced by one-third for a like period. Quebec is to be the summer terminus and Halifax the winter port. Mr. James Huddart, promoter of the enterprise, and with whom the Dominion Government has made a provisional contract, allowing three months to raise the necessary capital, expresses confidence in his ability to carry out the scheme.

Equipment for a Coal Dock.

A notable shipment of shafting and pulleys was recently made by the Rice Machinery Co., 174 South Clinton street, Chicago, to the Northwestern Coal Railway Co., Superior, Wis., for use on its coal dock. The items are as follows: One piece of 5½ in. shafting, 7 ft. long; one 5½in., 17 ft. long; six 4¾in., 24 ft. long; eleven 4½ in., 24 ft.; six 4¼ in., 24 ft.; four 4 in., 24 ft.; four 3¾ in., 24 ft.; four 3½ in., 24 ft.; four 3¼ in., 24 ft.; four 3 in., 24 ft.; 47 pairs of flange couplings; 40 friction spools, 22x15 and 40 friction spools 15x12. All are to be coupled in one continuous line 1,250 ft. long, driven at one end by a 500 h. p. rope drive. The equipment comprises two 500 h. p. engines, so that one can be held in reserve or both be used if occasion requires. The shipment required four cars and comprised a total of 175,000 lbs.—*Iron Trade Review.*

The Twenty-foot Lake Channel.

Gen. Poe, of the United States Army, in charge of the Sault Ste. Marie work, has asked for bids for dredging near the mouth of the Detroit River that will form a part of the 20-ft. channel work. The shoal is bed rock and other material and is in section 8, or the Detroit River part of the ship channel, where L. P. & J. A. Smith, of Cleveland, are already engaged on a large contract. The work to be done consists in excavating a channel about 800 ft. in length and 400 ft. in width, to a clear depth of 21 ft. below the datum plane established for section 8, ship channel. The estimated excavation above the 21-ft. plane is 5,000 cubic yards of bed rock, bank measure, and about 267 cubic yards, scow measure, of material other than bed rock. The estimated amount of bed rock, bank measure, between the 21 and 22-ft. planes is 6,202 cubic yards.

Improvements on the Chesapeake & Ohio.

The bridge across the Big Sandy River on the line of this road near Catlettsburg, Ky., near Ashland, is nearing completion, and will probably be ready for the passage of trains by November 1. The new structure is being built for double track and has five river spans and 977 feet of viaduct approach. The total cost will amount to about $475,000. All of the viaduct and three of the river spans are completed and the other two spans are in process of erection. In addition to this improvement the company is cutting out the tunnel at Caldwell, W. Va., and making a through cut for double-tracks. twenty-foot stone arches long enough for double-tracks are being constructed of two different points on the line, allowing the filling of two long and high wooden trestles. Iron girders and masonry are being put in at another point on the Huntington Division. This practically takes out all wooden structures between Clifton Forge and Huntington, leaving nothing but iron bridges or earth fills in their place. About $125,000 will be expended on the improvements.

The North West.

The big lake steamer North West went aground last Wednesday afternoon of last week on a shoal at Bar Point, near themouth of the Detroit River. The weather was foggy and she was going slowly at the time. One of the rudder chains parted, hence the grounding. She was pulled off the next morning, shortly after daylight, the wind having shifted so as to raise the water at the point. No damage was done to the hull and the ship proceeded on her way to Duluth. She had a good many first-class passengers on board, somewhere between 300 and 400. On her last eastward trip she carried something over 500 first-class passengers, and the officers of the company assure us that the ship is doing sufficient business to make her profitable. We trust this will be the case, for it is certainly a remarkably pleasant way of making the Northwestern journey.

Low Water in the Erie Canal.

Navigation is being considerably interrupted on the Erie Canal because of the low water, due to the severe drought. Boats at times are aground for hours.

The Niagara Falls Co.

The Niagara Falls Power Co. has filed with the Secretary of State, at Albany, N. Y., a certificate of an increase of its capital from $2,600,000 to $3,000,000. The company is authorized to issue $10,000,000 in stock. The $400,000 increase is to be used in the work of extending the company's plant at Niagara Falls.

New York Elevated—Third Track.

Judge Bischoff, of the New York Supreme Court, has decided that the Manhattan Elevated Railroad Co. has no right to lay a third track on the Ninth avenue line without first acquiring the easements from the property holders. It was claimed by the company that, unless some pecuniary damage could be shown, the property owners could not enjoin the building of the third track, but the Judge holds that this is incorrect. The substance of the decision is that, while the courts will not stop by injunction the operation of an elevated road whose construction has been acquiesced in by abutting owners whose easements of light, air and access are taken without compensation, an injunction will lie to restrain the building of a proposed structure until the easements threatened have been acquired by condemnation.

New York Central Coal Contracts.

The New York Central railroad has recently bought its supply coal for fuel for the year ending in June, 1895. It amounts to about 500,000 tons delivered on cars at Buffalo, and was secured at the exceedingly low price of $1.38 per ton of 2,000 lbs. The offers of the two bituminous coal railroads, the Buffalo, Rochester & Pittsburgh and the Western New York & Pennsylvania, owning each a coal mining company with coal lands, were accepted at the price named. The rate of freight is $1.10 per ton to Black Rock, equal to 95 cents per ton at Buffalo. Presuming that the railroad auditor credits to the account of freight the regular rates, 95 cents, it leaves but 43 cents per ton for the coal, or 17 to 22 cents less than a middleman can buy it for from the railroad coal companies named. The price paid by the New York Central lastyear was $1.60. *Buffalo Express.*

The Detroit Street Railroads.

The railroads operated by the Citizens' Street Railway Co., of Detroit, have been purchased by a syndicate formed by R. T. Wilson & Co., bankers, of New York City, who have been negotiating for the purchase of the lines for some months. J. M. Howard, of New York, has been elected President, and R. T Wilson, Treasurer, to represent the new owners. The control is secured by the purchase of a majority of the stock, under the terms of the contract made by the old company with Thomas Nevins, of Orange, N. J.

The World's Wheat Crop.

The annual crop estimates issued by the Hungarian Ministry of Agriculture are just published. The wheat crop of the world will be 2,476,000,000 bushels for 1894, against 2,279,000,000 bushels for 1893 and 2,280,000,000 bushels, the official average for the past decade. The deficit to be covered by importing countries is 364,526,000 bushels for 1894, against 379,000,000 bushels in 1893. The surplus from exporting countries is 444,245,000 bushels, against 378,664,000 bushels in 1893.

The detailed figures representing the production and deficit of the various important importing countries for the year 1894 are as follows:

	Production. Bushels.	Deficit. Bushels.
Great Britain	60,995,000	170,220,000
France	354,625,000	19,859,000
Germany	102,132,000	32,625,000
Italy	120,228,000	29,788,000
Belgium	21,277,000	25,533,000
Spain	97,876,000	12,768,000
Austria	45,400,000	31,774,000

The figures in detail of the production and surplus of the exporting countries are these:

	Production. Bushels.	Surplus. Bushels.
Russia	363,036,000	141,850,000
Hungary	151,098,000	45,392,000
Roumania	51,066,000	19,859,000
Turkey	29,793,000	5,675,000
Bulgaria	31,207,000	13,050,000
Servia	9,929,000	1,985,000
United States	408,528,000	70,925,000
Canada	42,555,000	15,603,000
India	258,167,000	22,696,000
The rest of Asia	58,158,000	2,837,000
Africa	48,370,000	5,957,000
Australia	42,895,000	14,185,000
Chili	24,114,000	9,929,000
Argentine Republic	117,508,000	73,762,000

London & Northwestern Railway of England.

The following is an abstract of the semi-annual report of the London & Northwestern for the six months ending June 30, 1894: Mileage, 1,893; capital, $579,121,105; (computed at £ equal $5.00).

Earnings:

Passengers	$8,658,415
Freight	9,750,310
Minerals	6,090,985
Live stock	489,325
Parcels, horses, carriages, dogs	1,875,570
Mails	470,760
Rents	467,875
Dividends	439,730
Balance brought forward	210,700
Total	$28,444,670

Expenses:

Working expenses	$15,323,255
Interest on debenture stock	2,649,210
Dividends: 4 per cent per annum on guaranteed and preference stocks	3,818,100
Dividend 5¾ per cent per annum on ordinary stock	5,778,430
Chief rents, leases, &c.	567,850
Balance carried forward	307,825
Total	$28,444,670

Number of passengers carried during the six months	33,019,978
" tons of freight " " " "	18,655,209
Mileage of passenger trains	10,175,510
" of freight "	9,986,420

Percentage of working expenses to traffic earnings, 55.13.

CAR BUILDING.

The car shops of the Northern Pacific Company at Edison, near Tacoma, Wash., will be reopened this month with a force of about 350 men. The shops have been closed since the strike in July. At that time about 275 men were at work. Superintendent McCabe is hopeful that the building of new cars will again be undertaken at these shops before the end of the year.

The Madison Car Co., of Madison, Ill., which assigned on July 1, 1893, will resume operations in a few days, with about 600 men. Its first work will be to build 100 coal cars for the St. Louis & Eastern Road.

The Carlisle Mfg. Co., is now employing about 300 men at its car shops at Carlisle, Pa. This part of its plant has been opened for several weeks now after having been closed since last September. The company has secured enough orders to warrant a further increase of about 100 in its force in this department. In the frog and switch works department of the same company a good deal of work is being turned out. The Elliott Car Works at Gadsden, Ala., have also resumed work on several large orders after a long idleness. The Madison Car Works are also running as reported elsewhere.

Secretary I. F. Peters of the Memphis Car & Foundry Works reports that the new plant of that company near Memphis, Tenn., is now practically completed and that the directors expect to have the shops in operation sometime during the present month.

The Michigan Peninsular Car Co. has an order from the Toledo & Ohio Central for 100 coal cars, which was placed during August. The cars are now nearly ready for delivery.

BRIDGE BUILDING.

Allentown, Pa.—A few months ago a board of viewers made a favorable report on the application for a new bridge to connect Allentown and South Allentown via Fifth street, and this week another structure to connect Allentown and Salsbury via Eighth street, received the favorable consideration of the viewers. The Eighth street bridge will be about 1,250 ft. long, and will span the Little Lehigh River, and the Lehigh Valley Railroad tracks. It will be 80 ft. high. The cost will be about $100,000. Viewers have made favorable reports for two new bridges over Jordan Creek, one in Lowhill township, between Schneckville and Lyon valley, and the other in Lynn township between Lynnville and Weidasville.

Chambersburg, Pa.—Viewers have reported in favor of a bridge over Antietam Creek at Good's Landing in Washington township.

Fort Lynn, Ark.—The contract has been let to M. S. Cartter & Co., of St. Louis, for the extension of an iron bridge for the Texarkana & Shreveport Railroad across the Sulphur River at Fort Lynn, 25 miles south of Texarkana and near the present terminus of the road.

Franklin, Pa.—The court has ordered the erection of a new bridge across Mill Creek on the road from Utica to Summit.

Hartford, Conn.—The State Bridge Commissioners have ordered plans prepared for a bridge across the Connecticut between Hartford and East Hartford. The present bridge was built in 1818 and is considered no longer safe for the traffic.

Helena, Mont.—Sealed proposals will be received by J. S. Tooker, County Clerk, Helena, for the construction of two iron or steel bridges, over Ten Mile Creek, in Helena. Each will have a single span of 65 ft., one to be 24 ft. in the clear, with 5 ft. sidewalks, the other to be 22 ft. in the clear, without sidewalks.

Millersburg, Pa.—Hiram Chubb, of Halifax, Pa., has been awarded the contract for the abutments of the new iron County bridge over Wiconisco Creek, about one mile above Millersburg, at his bid of $539. The contract for the superstructure has not yet been let.

Plymouth, Pa.—The contract for the new bridge across the Susquehanna River, from Buttonwood to Plymouth, was awarded to the Penn Bridge Co., of Pittsburg. Work has been begun. The new bridge will be of iron and will be for foot, wagon and railroad traffic.

Scranton, Pa.—A resolution has been presented in Councils instructing the city engineer to prepare plans for a new bridge over Leggett's Creek at Welles street, and calling for the removal of the present bridge at North Main avenue.

Washington, D. C.—The President has signed the following bridge bills; to authorize the Biloxi & Back Bay Bridge Co. to construct and, maintain a bridge over that portion of the Bay of Biloxi, in the State of Mississippi, known as Back Bay; to authorize the construction of a bridge across the Osage River, in the State of Missouri; to authorize the construction of a bridge across the Missouri River at De Witt, Carroll County, Mo.; to authorize the St. Louis, Avoyelles & Southwestern Railway Co., to bridge Bayou des Blaises and Atchafalya River, La.; to authorize the construction of a bridge over the Contentnea Creek at Grafton, Lenoir County, N. C.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Northwestern, 1¾ per cent on the preferred stock, payable Sept. 24.

Delaware & Hudson Canal Co., quarterly, 1¾ per cent., payable Sept. 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago, Milwaukee & St. Paul, annual, Milwaukee, Wis., Sept. 22.

Louisville, New Albany & Chicago, annual, Indianapolis, Ind., Sept. 19.

St. Louis Southwestern, annual, St. Louis, Mo., Oct. 2.

Toledo, St. Louis & Kansas City, Toledo, O., Sept. 12.

Wabash, annual, St. Louis, Mo., Sept. 11.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Roadmasters' Association of America* will hold its annual convention in New York city beginning Sept. 11, and lasting three days. The first meeting will be held in Tammany Hall, and the following ones at the

Broadway Central Hotel, which will be the headquarters of the Association.

The Master Car & Locomotive Painters' Association will hold its annual convention at Buffalo, N. Y., on Sept. 12, 13, 14. The headquarters will be at the Genessee Hotel.

The *American Association of General Passenger and Ticket Agents* will hold its semi-annual meeting at the Hotel Frontenac, Quebec, on Sept. 18.

The *Travelling Engineers' Association* will hold its annual convention at Denver, Colo., beginning Sept. 11. The headquarters will be at the Albany Hotel.

The *American International Association of Railway Superintendents of Bridges and Buildings* will hold its annual meeting in Kansas City, Mo., beginning Oct. 16.

The *Western Railway Club* meets in the rooms of the Central Traffic Association, Monadnock Building, Chicago, on the third Tuesday in each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York city, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station, on the Friday following the second Wednesday of March, June, Septembe and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 51 Lakeside Building, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m. The next meeting will be held on September 19.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St Louis, on the first and third Wednesdays in each months.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minnapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Foundrymen's Association* meets at the Manufacturers' Club, Philadelphia, Pa., on the first Wednesday in each month.

Iowa Central.—The company having withdrawn from the joint agency heretofore maintained with the C., M. & St. P. Ry. at Cincinnati, T. H. Whittemore has been appointed traveling freight agent for the company, with headquarters at the Fosdick Building, 59 West Fourth street, Cincinnati.

Western Society of Engineers.

The meeting of the society was held July 11, at which 30 members and guests were present, Mr. T. T. Johnston presiding. The Secretary read the report of the Board of Directors recommending the appointment by the society of Committees on the Library and Entertainment and Excursions. These committees were later appointed as follows: On Library: Messrs. O. Chanute, John Lundie, Fred Davis, H. M. Sperry and C. J. Roney. On Entertainments and Excursions: Messrs. H. E. Horton, Robert A. Shailer, F. Hall, J. J. Reynolds and Emil Gerber. Messrs. H. A. Boedker, William Graham and Edward Wilman were elected to membership. The reservoir of the Rockford Water Works was then described and a paper read by Mr. C. C. Stowell of Rockford, Ill. Prof. D. C. Jackson of Madison, Wis., also read a paper on the Electrolysis of iron pipes by the return electric current which was discussed by Mr. O. M. Rau of the Milwaukee Street Railway Co. and A. V. Abbott of the Chicago Telephone Co., and a number of others.

PERSONAL.

—Mr. M. S. McCay, formerly Superintendent of the San Luis division of the Mexican Central Railroad, has been appointed General Superintendent of the Mexico, Cuernara & Pacific Railroad.

—Mr. Frank E. Knight, of the New York office of the Lidgerwood Mfg. Co., has been placed in charge of the company's cableway interests in Chicago, with an office in the Old Colony Building.

—Mr. John W. Davis has been appointed Superintendent of the plant of the Cleveland Steel Casting Co., which was built in 1894. He has been manager for over two years the Aschman Steel Casting Co., Sharon, Pa.

—Mr. O. E. Grady, Division Superintendent of the Lake Erie & Western Railroad, at Lafayette, Ind., has resigned. Trainmaster Crawer, of Muncie, Ind., has been appointed his successor, as Superintendent of the Peoria division.

—Mr. W. E. Dresser, Superintendent of Telegraph of the Costa Rica Railroad with headquarters at Port Limon, Costa Rica, has resigned that position to return to the United States and settle the affairs of his father's estate in Maine.

—Colonel A. W. Wildes, of Skowhegan, a member of the Maine Railroad Commission, died at Augusta, on Sept. 1, of congestion of the lungs. He was 70 years old. He had been a member of the Railroad Commission for nearly 30 years.

—The Directors of the Western Railway of Alabama have elected Mr. George C. Smith of St. Louis President and General Manager. This appointment will result in the retirement of former President C. H. Phinizy and General Manager E. L. Tyler. Mr. Smith was formerly Assistant General Manager of the Missouri Pacific road.

—Mr. D. H. Conklin, who has been General Manager of the South Alantic & Ohio Railroad in eastern Tennessee since 1891, has resigned that office and the directors of the company have taken occasion in announcing his retirement to issue a complimentary circular expressing appreciation of his service as General Manager of the company.

—Mr. John C. Gault, the former railroad manager whose illness was reported in this column last week, died at his home in Chicago on August 27. Mr. Gault had been stricken with apoplexy on the previous Tuesday while at the Board of Trade in Chicago. This attack was followed by general paralysis, and he was unconscious during the entire week's illness except for one or two hours and then he was unable to speak.

—Mr. M. Barr, who recently resigned as division superintendent of the Chicago, Milwaukee & St. Paul, has been appointed Superintendent of the Breckenridge division of the Great Northern, with headquarters at Willmar, S. D. Russel Harding has been appointed Superintendent of the Dakota division at Larimore, N. D., vice E. J. Evans, resigned. Prior to his service with the Milwaukee road, Mr. Barr was Superintendent of the Eastern division of the Burlington road.

—Mr. J. K. Finley died at Emporia, Kan., on August 24, where he had lived for some years and was one of the most prominent business men in the town. Some years ago Mr. Finley was an important railroad contractor and did a good deal of work on the Union Pacific and Atchison Railroads. His chief contract on the latter line was in the construction of the branch from Emporia to Moline, Kan. He was one of the projectors of the company organized to build the railroad and after did nearly all of the contracting work.

—The death of Gen. N. P. Banks at Waltham, Mass., on September 1, recalls one period in his active and eventful life which is not likely to take up much space in the newspaper notices of his career, but may very well be noted in this column. This was his Presidency of the Illinois Central Railroad, which he accepted in 1860, after the expiration of his term as Governor of Massachusetts. He held that office until the breaking out of the Civil War when he resigned to accept his commission as Major General in the Federal Army.

—Col. Aldace F. Walker, the new receiver of the Atchison, Topeka & Santa Fe Railroad, arrived in New York from Antwerp on September 3, and immediately assumed his duties as receiver of the Atchison Railroad. He proposes to remain in New York for some time familiarizing himself with the present condition of the property. Then he will go over the railroad with the other receivers and the principal officers of the company and after completing the inspection of the property he will probably make his headquarters in New York City.

—Mr. Charles M. Pond, who was formerly interested in railroad interests, not only by descent, being a son of the late C. F. Pond, President of the Hartford, New Haven & Springfield R. R., but also by actual experience, died at Hartford, Conn., on August 28, aged 57 years. Mr. Pond had lived in Hartford nearly all his life and was prominent both in political and business matters, having been a State Senator and Treasurer, and also a director or president in a number of Hartford corporations. He was Treasurer for some time of the railroad of which his father was President and which afterwards was absorbed by the New York, New Haven & Hartford, when Mr. C. M. Pond retired from its service. His latter interests were as President of the Hartford Trust Co., which he helped to organize, and as Director in the Hartford Magnetic Ore Co., and various insurance and other corporations.

—Mr. D. W. Caldwell, President of the New York, Chicago & St. Louis, was this week elected General Manager of the Lake Shore & Michigan Southern to succeed the late John Newell, who was President and General Manager. Mr. Caldwell is an old and experienced railroad man. He has been in railroad service over 42 years, and has been the successful manager of important properties nearly 25 years. His career began on the Pennsylvania Railroad in 1852 as a clerk, and he was successfully Civil Engineer and Superintendent and General Superintendent on the branch roads of that company. In 1874 he was General Manager of the Pittsburgh, Cincinnati & St. Louis and other western lines of the Pennsylvania Railroad until 1882, when his title was General Manager of the Pennsylvania lines west of Pittsburgh. In that year he became Vice-President of the New York, Chicago & St. Louis, and was made its Receiver in 1887 when it became bankrupt. Ater its re-organization he became President of the company.

ELECTIONS AND APPOINTMENTS.

Addyston & Ohio River.—S. Gano, Jr., has been appointed General Manager, with headquarters at Cincinnati, O.

Atlantic Coast Line.—W. G. Pulliam, who has been in the service of the Atlantic Coast Line for a number of years, has been appointed freight claim agent with headquarters in Wilmington, N. C.

George H. Cardwell has been appointed chief clerk in the traffic department, with office at Wilmington, N. C.

Baltimore, Chesapeake & Atlantic.—The following is a list of the directors of this company, which is a reorganization of the Baltimore & Eastern Shore Railroad: John E. Searles, of the American Sugar Refining Co.; Brayton Ives, President of the Western National Bank, New York City; William F Havemeyer, Charles E. Pomeroy, of Post & Pomeroy; Winthrop M. Tuttle, of the National Investment Co., all of New York City; Enoch Pratt, and N. P. Bond, of Baltimore; Henry P. Scott, of Elliot, Johnson Co., and Thomas B. Smith, Vice-President of the Equitable Guarantee & Trust Co., Wilmington, Del.; Willard Thomson, General Manager for the new company, Wilmington Del.; Carrol S. Tyson, of the Phoenix Iron Co., Philadelphia, and J. S. Ricker, President of the Baltimore & Annapolis Short Line Railroad, Portland, Me.

Bangor & Aroostook.—The county of Aroostook, through its senators and representives at a meeting held this week, chose the following to serve as directors of the railroad company: Thomas H. Phair, Presque Isle, Me.; Charles P. Tenney and E. L. Cleveland, Jr., Houlton.

Boston & Maine.—H. E. Howard has been appointed Superintendent of Car Service, with office at Boston, Mass., vice George S. Hobbs, resigned to accept the position of Auditor of the Southern Railway Co.

Calumet & Blue Island.—C. E. Dearborn has been appointed Chief Engineer with headquarters at Chicago, Ill.

Carrabella, Tallahassee & Georgia.—M. B. Rice has been appointed Superintendent of this road in charge of transportation matters, with headquarters at Tallahassee, Fla. He is also Chief Clerk to the General Manager, J. A. McDuffie.

Chicago, Milwaukee & St. Paul.—The resignation of J. M. Barr, as Division Superintendent, has involved the following changes: Superintendent J. B. Cable is transferred from the Kansas City division to the Chicago & Milwaukee, Chicago & Council Bluffs and Chicago and Evanston divisions, vice J. M. Barr, resigned. Superintendent J. F. Gibson is transferred from the Northern to the Kansas City division. Superintendent J. M. Bunker is transferred from the James River to the Northern division. J. H. Foster is appointed Superintendent of the James River division. Trainmaster C. S. Scott is transferred from the Southern Minnesota to the River, Chippewa Valley and Wabash divisions. E. C. Perkins is appointed trainmaster of the Southern Minnesota division.

Cincinnati, Georgetown & Portsmouth.—J. M. Myers has been appointed Superintendent of this line, vice Frank McQuiston, resigned, with office at Cincinnati.

Chittenden County.—The organization of the company in Burlington, Vt., last week, resulted in the election of the following directors and officers: William G. Dacey, of New York; James H. McCrearey, of New York; A. P. White, of Philadelphia; R. B. Lawrence, of New York; F. O. Sinclair, J. B. Henderson and C. W. Brownell, of Burlington; Albert Ray, of Hinesburgh, Vt.; S. A. Brownell, of Essex Junction, Vt. W. G. Dacey, of New York, President; A. P. White, of Philadelphia, Vice-President; R. B. Lawrence, of New York, Secretary and Assistant Treasurer; C. W. Brownell, of Burlington, Treasurer; F. O. Sinclair, of Burlington, Chief Engineer and Clerk.

Cleveland, Cincinnati, Chicago & St. Louis.—James A. Keegan has been appointed Master Mechanic of the Cincinnati and Sandusky divisions, with office at Delaware, O., vice J. H. Berry resigned; effective from Sept. 1.

Cleveland, Cincinnati, Chicago & St. Louis.—James A. Keegan has been appointed Master Mechanic of the Cincinnati & Sandusky division, vice J. H. Berry resigned, with headquarters at Delaware, Ohio.

Cumberland & Pennsylvania.—Lewis M. Hamilton has been appointed General Superintendent, with headquarters at Cumberland, Md., vice P. L. Burwell, appointed Consulting Engineer.

Eastern Maine.—At a meeting of stockholders of the company held recently at Rockland, Me., the following directors were chosen: Eugene Hale, L. A. Emery, Ellsworth; Davis Tillson, G. W. Kimball, Rockland; S. D. Bailey, Bath. The Board of Directors was organized by the choice of Mr. Hale as President; Mr. Kimball, Vice-President and Treasurer, and Mr Emery, Clerk.

Erie & Wyoming Valley.—S. D. King, purchasing agent and superintendent of the stock of the Pennsylvania Coal Co., at Pittston, for several years, has been made superintendent of motive power of this road, with office at Dunmore, Pa.

Flint & Pere Marquette.—E. F. Weld having resigned, H. D. Norris has been appointed Purchasing Agent, with headquarters at Saginaw, Mich.

Ketner, St. Mary & Shawmut.—B. J. Cato has been appointed General Freight Agent and Auditor, with office at Bradford, Pa., vice B. E. Cartwright and L. P. Snyder, resigned.

Lake Charles & Leesville.—The officers of this road are as follows: W. E. Ramsay, President and General Manager; C. S. Ramsay, General Superintendent and Purchasing Agent; Chester Brown, Traffic Manager; W. G. Martin, Chief Engineer; all at Lake Charles, La.

Lake Shore & Michigan Southern.—A. A. Bradeen has been appointed Master Mechanic, with headquarters at Cleveland, O., vice J. S. Graham.

Minneapolis & St. Louis.—W. H. Benn has been appointed Traveling Passenger Agent, with headquarters at Minneapolis.

Montgomery, Haynesville & Camden.—The annual stock holders' meeting of the railroad at Camden, Ala., on August 27, resulted in the re-election of Solomon D. Block, President; Judge J. W. Beck, R. E. McWilliams, L. E. Starr and D. Palmore, Directors.

New York & New England.—The title of F. E. Dewey, Superintendent of Transportation, has been changed to General Superintendent. Mr. Dewey will continue as Superintendent of the Eastern and Norwich & Worcester Divisions as hereofore.

Northern Pacific.—George Wentworth, assistant superintendent of the Pacific division of the Northern Pacific, has moved his headquarters from Ellensburg to Tacoma, Wash.

Seaboard Air Line.—William B. Clements has been appointed District Passenger Agent, with office at No. 601 Pennsylvania avenue, Washington, D. C. W. I. Flournoy, Traveling Passenger Agent, formerly located at No. 601 Pennsylvania avenue, Washington, D. C., has been transferred, with headquarters at No. 6 Kimball House, Atlanta, Ga.

Southern Railway Co.—Circulars have been recently issued announcing the organization of divisions for the operation of the system. The Eastern system is divided into three divisions. The first division includes the line from West Point to Neapolis (Danville) and the Virginia Midland branches and the other lines in Virginia and North Carolina as far west as Greensboro, N. C. J. S. B. Thompson is Superintendent with headquarters at Danville, Va. The second division is from Danville to Atlanta, including the North Carolina Midland road and various branches. W. B. Ryder is Superintendent with headquarters at Charlotte, N. C. The third division includes the line west of Salisbury to Murphy, N. C., from Charlotte to Augusta and from Columbia to Greenville. E. Berkeley is Superintendent with headquarters at Columbia, S. C. Mr. Thompson's headquarters are transferred from Richmond, but he has jurisdiction over practically the same lines as heretofore; Mr. W. B. Ryder is transferred from Columbia, S. C., to Charlotte and Mr. Berkeley is transferred from Greensboro.

On the Western Division, formerly the East Tennessee, Virginia & Georgia, four divisions are created. The main line from Bristol to Chattanooga is included in the fourth division with F. K. Huger as Superintendent at Knoxville, Tenn. The fifth division is the line through Atlanta to Brunswick, including the lines from Rome to Atlanta and to Birmingham. W. R. Beauprie is Superintendent with headquarters at Atlanta, Ga. The sixth division includes the line from Birmingham west through Mississippi to Greenville, and the lines south of Birmingham. J. N. Ross is Acting Superintendent at Birmingham, Ala. The seventh division is the old Louisville Southern road and is in charge of George R. Loyal, Superintendent at Louisville, Ky. Mr. Huger and Mr. Beauprie were formerly Divsion Superintendents on the East Tennessee road, and Mr. Rosss was acting Superintendent at Birmingham. By this arrangement of the lines for operation the following positions are abolished; Assistant Superintendent of the Virginia Midland Division at Charlottesville; Superintendent North Carolina Division at Greensboro; general Superintendent of the Western System; Superintendent of the Alabama Division at Selma (J. M. Bridges) Superintendent of the Brunswick Division (E. T. Horn) and Master of Trains at Knoxville.

The jurisdiction of C. M. Bolton, formerly Chief Engineer of the Richmond & Danville, and of R. D. Wade, Superintendent of Motive Power, and of C. A. Dalton, Superintendent of Telegraph, has been extended to include both the Eastern and Western systems. G. H. Thomas has been appointed Assistant Superintendent of Motive Power with office at Washington, D. C.

Mr. John A. Dodson, formerly Superintendent of the A. & C. Air Line division, has been appointed General Roadmaster of the East Division in charge of the maintenance of roadway and structures with office at Washington, D. C. He will be assisted by the roadmaster of each division located at Greensboro, Charlotte and Asheville, N. C.

D. W. Lum, formerly Chief Engineer of the East Tennessee, has been appointed General Roadmaster of the western division, in charge of the maintenance of roadway and structures; with office at Knoxville, Tenn. He will be assisted by a Roadmaster for each division, located at Knoxville, Tenn., Birmingham, Ala., and Atlanta, Ga. The office of Engineer of Maintenance of Way on both the Eastern and Western Divisions has been abolished. There were six such offices on the Richmond & Danville line.

W. A. Vaughn, formerly General Superintendent of the East Tennessee lines, becomes Superintendent of the Car Service on all lines, with office at Washington, D. C.

Harry C. Ansley, who was appointed Acting Treasurer in July on the death of John W. Hall, has been appointed Treasurer with office at Washington.

St. John & Lake Eustis.—J. W. Kelly has been appointed Auditor and Acting General Freight Agent of this company, vice S. C. Harrison, resigned, with office at Leesburg, Fla.

St. Johnsbury & Lake Champlain.—W. F. Berry has been appointed General Traffic Manager, and M. T. Donovan has been appointed General Freight Agent, with office at Boston, these officers holding similar positions on the Boston & Maine.

RAILROAD CONSTRUCTION.

Altoona & Phillipsburg Connecting.—The railroad has been completed from Phillipsburg to Ramey, Pa., and was opened for business as far as Houtzdale last week. The new road, which will open up important new coal fields, will connect with the Beech Creek road, and form an important feeder for both that road and the Philadelphia & Reading. It is being built by S. P. Langdon, of Philadelphia.

Birmingham, Sheffield & Tennessee River.—Receiver E. A. Hopkins has made arrangements for the extension of the road from the present terminus at Little Shoals, to the Warrior River. An engineering party is now in the field in charge of Capt. John S. Foster.

Chicago, Paducah & Memphis.—The track on this railroad was laid into Benton, Franklin County, Ill., last week, and the incident was celebrated by the townspeople with a good deal of enthusiasm. This brings the terminus of the railroad to a point half-way between Mt. Vernon and Marion. The railroad as surveyed extends from St. Elmo, North of Mt. Vernon, to the Ohio River opposite Paducah, Ky. It was projected by Johnston Bros. & Faught, of St. Elmo, who were further interested in the railroad as contractors.

Chittenden County.—The final surveys for this short railroad through Chittenden County in Vermont are to be made this month under the direction of F. O. Sinclair, of Burlington, the Chief Engineer. All matters relating to the construction of the railroad are now satisfactorily arranged. The contracts for building the road are to be let this fall. The formal organization of the company was completed at a recent meeting at Burlington, Vt. The railroad is to be about 12 miles in length to reach the towns of Burlington, Shelburne, St. George and Hinesburg. The road will run into Burlington over the Burlington & Lamoille, now controlled by the Central Vermont, with which an agreement to this end has been effected. The capital stock is $200,000, all of which has been subscribed. The town of Hinesburg has also voted $25,000 toward this project. W. G. Dacey, of New York City, is President of the company. The directors will ask the next month legislature to change the name of the railroad to the Burlington & Hinesburg.

Dry Fork.—It is expected to open up the road for traffic on October 1, from Hendricks to Wharton, a distance of 35 miles. The line is now completed from the junction with the West Virginia Central & Pittsburg, at Hendricks, W. Va., to a point two miles west of Thorne Grove, in Randolph County, W. Va., a distance of 35 miles south of Hendricks. It follows the Dry Fork of Cheat River for about 32 miles to the confluence of the Gandy and Dry Forks; thence it follows the Gandy to the Alleghany divide, or 15 miles south of the present terminus. Robert F. Whitmer is President, F. K. Bretz, General Manager, and John W. Moore, Jr., Chief Engineer.

Grand Trunk.—The Owen Sound branch, from Park Head on the Georgian Bay division to Owen Sound, Ont., a distance of 14 miles, has been opened. The work was projected three years ago by local parties, but it was not until the spring of the present year that the contractors, Col. Tisdale, M. P., and J. C. Boyd commenced operations. The branch touches Shallow lake, near which valuable deposits of natural cement are found. The rest of the country through which the line runs is well settled farming lands.

Gulf, Beaumont & Kansas City.—The contract for the extension of the line beyond Buna, Tex., a town north of the Neuces River, to which the railroad is now built, has been let to Schneider Bros. and H. Hanson. Their contract is for 15 miles of road through Jasper County. Vice-President John H. Kirby has again returned to Boston to consult with the eastern directors who are furnishing the funds to carry on the work. The road will develop a good timber district in eastern Texas, but it is built chiefly to reach the stone quarries in the north of Jasper County, near the town of Jasper.

Gulf & Interstate.—The most recent work on this railroad has been a survey for a branch of the line to Beaumont in Jefferson County, Texas, which is now reported to have been completed. The engineering work is now in charge of A. G. Titus as Chief Engineer. The officers report that they expect to complete an agreement within a few weeks with the King & Charles Construction Co. to undertake the building of the railroad in Texas. Just who compose this company is not divulged, but it is said that some of those interested in it come from Pittsburgh, Pa. Mr. D. J. Mackey, of Evansville, Ind., formerly President of the Louisville, Evansville & St. Louis Railroad is aso expected to have some interest in the company.

Lake Aioskawasting.—The construction of the proposed railroad to reach the property of the Schoonmaker estate at Lake Aioskawasting, at the summit of one of the Shawangunk mountains in New York, which was referred to in our issue of July 20, has been deferred. The railroad was to start from Gardiner in Ulster County, N. Y., on the line of the Wallkill Valley Railroad, and extend thence to the lake. Julius Schoonmaker, one of the executors of the Schoonmaker estate, and Emanuel Metzger, of Kingston, N. Y., propose to organize a stock company to devolop the property and to build a summer resort at the lake, but this development will not be undertaken until some part of the 5,000 acres belonging to the estate has been sold.

Lake Charles & Leesville.—This road has been opened for business from Banks, La., northward to Bundicks, La., a distance of 38 miles. The company has steamer connection at Banks with Lake Charles. The points named as the termini of the railroad are new towns and are not postoffices.

Lake Katrine.—The project for a proposed railroad from Kingston City to Lake Katrine, a summer resort some 10 miles from Kingston, has fallen through. Robert J. Dwyer, of Rondout, N. Y., a member of the Lake Katrine corporation, states that no attempt will be made to build the railroad this year. The project has not been abandoned entirely and it is hoped by next year to complete some arrangement for building the railroad.

Mexican International.—A report was revived this week in a press dispatch from Mexico of the intention of Mr. Huntington to complete this year the extension begun in 1893, to the mining districts in the Sierra Mojada mining districts. This extension is already graded for nearly 100 miles, built from a present line at Monclovia south to Sierra Mojada. The total distance is 160 miles.

Monterey & Fresno.—President A. W. Jones, of this railroad, is now on his way from California to New York City on matters connected with the financing of the project. Colonel Jones last Winter spent some months in New York promoting the project, and he expects that on his present visit he will be able to finally conclude his financial arrangements within two weeks and return to California to direct the construction of the railroad. The grading on the line was begun near Monterey in July and since that time has been going on slowly. About 8 miles is now ready for the track laying east of that town and it is expected to reach the Salinas River this month, where work will be delayed until the bridge can be put in.

Monterey & Mexican Gulf.—Mr. J. A. Robertson, General Manager of this railroad, is now on his way to New York from Mexico, the chief object of his visit being, it is reported, in relation to the extension of the railroad from Trevino to the mines at Sierra Mojada, Mex. This extension if built will bring the road into competition with the Mexican International Railroad, which already has a graded road-bed to this district, entering it from the north and on which, undoubtedly, the track will be laid some time in the near future.

Nakusp & Slocan.—This branch, by which it is intended to open up continuous communication throughout the year between the Canadian Pacific main line at Revelstoke, B. C., and the Kootenay mining district at Nelson, in the southern part of the province, is still being delayed in the construction work. Early in the year it was intended to have the line open for operation during July. The track-laying has been completed from Nakusp to the head of the Slocan Lake and is now near the town of New Denver, and it is thought that work will be completed to the terminus at Three Forks during October. The distance is 38 miles. The Canadian Pacific has a line from Revelstoke south to Upper Arrow Lake, built in 1893, and from that point it has steamer communication on the Columbia River, to Robson, near the boundary line. A branch railroad is operated from that point to Nelson, but this line of communication into the Kootenay district is only opened during the summer months. By building the Nakusp & Slocan Railroad the company will be enabled to secure direct communication with the great mining district in southern British Columbia, by a line which can be operated during the entire year.

Nelson & Fort Sheppard.—The short extension of the line needed to bring it into the town of Nelson, B. C., is likely to be undertaken this fall. An adjustment between the company and the contractor, Larson, who built the line north of Northport, is expected to be arranged in a short time and then the line into the town will be undertaken. At present, the road is not operated beyond a temporary terminus, outside the town of Nelson, near Five Mile Point on the Kootenay River, and freight has to be carted into the town.

New Roads.—A party of engineers under Chief Engineer H. A. Sumner, of the Florence & Cripple Creek Railroad, has begun a survey from Florence to Silver Cliff, Col.

Ohio & Kentucky.—A company of this name has been recently incorporated in Kentucky to build a railroad from Morehead to Walnut Grove, a distance of 36 miles. The capital stock is $300,000 and the principal office is at Ashland, but all the incorporators are at New York City, and include H. S. Little, W. D. Walbridge and R. M. Bross.

Opelika & Auburn.—A company has been organized at Opelika, Ala., to build a light railroad from that town to Auburn, a distance of 7 miles. Rails for four miles of the road have been delivered at Opelika. The capital stock is $40,000, all paid in. The president and most prominent stockholder is M. E. Gray, of Columbus, Ga., who was Superintendent of the Georgia Midland & Gulf Railroad. The directors are M. E. Gray, J. L. Cowan, Vice-President H. L. Slaughter, C. J. Daughtry and J. L. Renfro.

Path Valley.—Work on the tunnel southwest of New Germantown has been suspended, McGovern, Bros., who had the contract, having failed. The grading is still going on slowly on the Franklin and Perry county sides of the mountain. This line is an extension of the Newport & Sherman's Valley road, from New Germantown, Perry County, to Fannettsburg, Franklin County.

Pennsylvania Midland.—Track-laying was begun at Cessna, August 28, and is being pushed with vigor. A connection has been made with the Pennsylvania's Bedford Division, at Cessna. Work was begun on the branch line from near Osterburg to Ashlota, Somerset County, this week. George B. Orlady, of Huntingdon, Pa., is President and E. A. Tennis of Thomsontown, contractor.

Pennsylvania, Poughkeepsie & Boston.—The foreclosure sale of this railroad in the suits of the Holland Trust Co. will take place at Trenton, N. J., on Sept. 18. The sale is in accordance with the decrees entered in the United States Circuit courts for New Jersey and Pennsylvania during last June. About 47 miles of railroad will be included in the sale. This includes the line beginning at Slatington, in Lehigh County, Pa., to Slate Valley, 3 miles; Howe's Junction to Bender's Junction, 9 miles more; from Pen Argyl, Pa., across the Delaware River near Portland to Hainesburg, N. J., 13 miles; from Swartzwood, N. J., to the New York State line near Liberty Corner 22 miles, and the additional rights of way, grading and unfinished roadway on the surveyed lines in Northampton County, Pa., between Bender's Junction and Pen Argyl, and in New Jersey between Hainesburg and Swartzwood, together with the rights, under its trackage contracts with the Lehigh & Lackawanna for the use of the tracks beteen Bender's Junction and Pen Argyl 8 miles, and with the New York, Susquehanna & Western for the use of its tracks between Hainesburg and Swartzwood, 18 miles. The minimum price fixed by the court for the property is $350,000.

Quebec Central.—Hope & Lukes, the contractors for the Lake Megantic extension of this railroad, now have nearly 1,200 men on this branch. It leaves the present Point Levis & Sherbrooke line of the company at Tring, near St. Frederick, and extends southeasterly to an extension with the Canadian Pacific at Lake Megantic, Quebec. The length of the branch is 58 miles and it will considerably shorten the distance between Quebec and Halifax and other points in the Maritime Provinces. The rails are now laid for over 20 miles and the entire line is expected to be ready for operation early next spring.

Rumford Falls & Rangeley Lakes.—The directors named in the articles of association of this company have petitioned the State Railroad Commissioners of Maine that their association be incorporated for the purpose of building a 10-mile road. The capital stock is $60,000.

Salt Lake City & Mercur.—The Mercur Mining Co., which is building this railroad to give its mines a connection with the Union Pacific railroad at Fairfield, Utah, has commenced the track laying on the road from Fairfield. The line is not long and is being built by Daniels & Holloway, of Provo, Utah, as contractors. The grading has been finished from the Union Pacific road to the company's mill and will reach the terminus at the mines in a few days.

St. Clair, Madison & St. Louis Belt.—There seems to be some active movement being made to secure the right-of-way for this railroad. It is projected to furnish a connection for the new Alton Bridge with all the railroads entering East St. Louis by building a line from the bridge south, intersecting all such roads and reaching the Mississippi River again at East Carondelet, Ill. There is no prospect that this entire line will be built at once and whether the projectors have any present intention of building any part of the line is uncertain. The reports now being printed about the work are very indefinite. These reports state that the rights of way have been purchased from Edwardsville through Collinsville to O'Fallon, on the Ohio & Missisippi road.

Toronto, Hamilton & Buffalo.—The interest in this project is being revived in Toronto by those connected with it, and last week they announced that President J. M. Young had been able to make some arrangement while in New York recently to commence work on the line between Toronto and Hamilton. It is said that the work between these points will be practically completed, so that when the company renews its application with the city of Toronto for a subsidy it will have some substantial evidence of its good faith as an endorsement for its application.

United (California).—The incorporation of this company in California is reported. The projectors propose to carry out the much discussed project for a new railroad, through the San Joaquin Valley, paralleling one of the Southern Pacific lines through that valley. The route is from Stockton, San Joaquin County, southwesterly up the San Joaquin Valley, through the counties of San Joaquin, Stanislaus, Merced, Madeira, Fresno, Tulare, nd Kings, and thence in a southerly direction through Kern County to Bakersville. The project is entirely distinct from that in which the California Traffic Association is interested, and Traffic Manager Leeds speaks strongly of the motives of the projectors in organizing at the present time, when, he declares, the Traffic Association was progressing favorably with its plans for building a railroad over this route. B. F. Langford, of Stockton, and R. H. Delafield, of San Francisco, are incorporators.

Waterville.—A company has been organized at Waterville Me., to build a railroad from Waterville to Weeks Mills, in the village of China, Kennebec County, a distance of 14 miles, to connect with the new Wiscasset & Quebec Railroad. The work will be commenced in about three weeks and is to be pushed to completion this fall.

The capital stock of the company is $50,000. The following Board of Directors has been elected: W. T. Haines, I. C. Libby, J. F. Arnold, John N. Webber, Frank Redington, and C. E. Gray, all of Waterville; Thomas Sampson, of Winslow; G. H. Cates and Warren Seaward, of Vassalboro.

Weiser & Idaho Northern.—The engineers who have been surveying this line north of Weiser, Idaho, are reported by the officers of the company to have completed the preliminary line to Seven Devils, the center of the important copper mining district in northern Idaho, which is about 100 miles north of Weiser, a town on the Snake River, located near a crossing of that river by the Union Pacific Railroad. A location has been made for the first 50 miles out of Weiser. A new company has recently been organized to carry out this project, which has been talked of for some years. The President of the new company is Leonidas D. Merritt, of Duluth, who, with a party of Duluth and Boston capitalists, spent several months this year in going over the route of the proposed road and in investigating the resources of the copper mines, the chief object of its construction. Thomas Bates is Vice-President, M. S. Sprote is Secretary and I. J. Richardson is Treasurer, the local headquarters being at Weiser, Idaho.

GENERAL RAILROAD NEWS.

Asheville & Spartanburg.—This road has passed into the hands of a receiver and will be sold at Spartanburg, S. C., as soon as Judge Simonton, of the United States Court for that district, fixes a day for the sale. Mr. James Swann, of New York, has been appointed receiver by the above-named judge.

Baltimore & Eastern Shore.—The foreclosure sale of the railroad and other property of this company took place at Salisbury, Md., on Aug. 29. The property was purchased for $400,000 by the reorganizaion committee of the bondholders. Since the sale the claim for the Scranton Steel Co. for rails furnished in 1892, amounting to about $80,000, has been settled, so that there will be no opposition to the confirmation of the sale. The purchase by the reorganization committee will result in carrying out the plan already described for consolidating the railroad, which extends across the eastern peninsula of Maryland from Claiborne on the east side of Chesapeake Bay to Ocean City on the Atlantic Ocean, about 90 miles, with the several steamship companies operating between Baltimore and the eastern side of Chesapeake Bay. These companies are the Maryland Steamship Co., the Choptank Steamship Co. and the Eastern Shore Steamship Co., and a majority interest in each of the companies has been purchased by a syndicate, now also owning the railroad, which includes John E. Searles, of New York, and other New York and Baltimore business men. A new company called the Baltimore, Chesapeake & Atlantic Railroad has been formed to operate the consolidated properties, and John E. Searles has been elected President and W. M. Tuttle, Secretary.

Beaver Meadow, Trescrow & New Boston.—The work of grading this new road is about completed and the track laying is progressing. The road will make connections with the Central of New Jersey, at Tresckow breaker and with the Philadelphia & Reading. A. S. Van Wickle, of Hazleton, is President, and Harry King contractor. The line will not be built to New Boston, as proposed, for the present.

Canadian Pacific.—The earnings of the company for July and the seven months to July 31, are as follows:

July:	1894.	1893.	Dec.
Gross earn	$1,517,609	$1,863,267	$345,658
Oper. expen	1,042,341	1,172,330	129,989
Net earn	$475,268	$690,937	$215,669
Seven months to July 31:			
Gross earn	$9,655,378	$11,323,265	$1,667,887
Oper. expen	6,894,879	7,563,058	668,179
Net earn	$2,760,499	$3,760,207	$999,708

The working expenses for July were largely increased by the extraordinary repairs to the line in British Columbia due to the floods.

La Porte, Houston & Northern.—One of the directors of this company announnces that the entire line of the railroad into La Porte, Tex., and the extension south of that town to Clear Lake, will be completed early in October. He also states that the connection with the North Galveston, Houston & Northern railroad near the town of North Galveston will also be finished at that date. Negotiations are now going on for the consolidation of the two linesfwhich will form a continuous railroad between Galveston and Houston, Tex.

Louisville, New Albany & Chicago.—A circular has been issued to the stockholders, announcing that at the annual meeting, to be held on Sept. 19, authority will be asked for the creation of $1,000,000 of equipment mortgage sinking fund bonds, payable in 20 years, with interest at 5 per cent. These bonds are to be secured by a mortgage on freight cars now in use by the company, but not wholly paid for. Officers of the company have already arranged for the sale of a sufficient number of these bonds to provide for all the equipment notes that have matured during the past year.

Manhattan.—The report of the company for the year ended June 30 last, filed with the New York Railroad Commissioners, shows: Gross earnings from operations, $10,153,576; operating expenses, $5,532,040; net earnings, $4,621,536; other income, $311,677; gross income, $4,933,214; fixed charges, $2,600,566; net income, $2,332,647; 6 per cent. dividend on $30,000,000 capital stock, $1,800,000; surplus for the year, $532,647; cash on hand, $346,956, and profit and loss surplus, $5,623,197. The net income for the preceding year was $2,921,291.

Minneapolis & St. Louis.—The re-organization plan published last week provides for the organization of a new company, after the sale of the property at foreclosure under the improvement and equipment mortgages, which is to take place on October 11. The new company will issue $2,500,000 first preferred five per cent. cumulative stock, $4,000,000 of second preferred stock and $6,000,000 of common stock. The new first preferred stock is issued to the old stockholders for the assessment of $25 per share, which is levied upon the present preferred and common stock. The amount of the second preferred and common stock is the same as that now outstanding. The only obligations of the present company which will be assumed by the re-organized company are the underlying six and seven per cent. mortgage bonds, the principal of which amounts to $4,718,000. A sufficient amount of the new issue of bonds is to be reserved to retire this underlying bond. This issue will be for $10,000,000.

Under the plan which has been prepared by the so-called Olcott committee, the fixed charges of the new company will be $580,540. A statement issued by the Committee shows that the net revenue of the property, after the payment of expenses and renewals, as shown by the Receiver's report, has been $876,138 for the year ending June, 1892, $782,619 in 1893, and $749,762 in 1894, so that the earnings have been sufficient each year to pay more than five per cent. dividends on the first prefetred stock. A guarantee syndicate, including August Belmont & Co., J. Kennedy, Tod & Co., and Vermilye & Co., of New York, has been formed to purchase outright $5,000,000 of the 40-year five per cent. bonds. It also agrees to pay the assessment and take the place of non-assenting stockholders.

Ohio Southern. — The stockholders will meet in Springfield, O., Oct. 4, to take action upon the recommendation of the directors to lease the partially built railroad of the Columbus, Lima & Milwaukee Railroad Co., from Lima to Defiance O.

Philadelphia & Reading.—The statement of earnings of the railroad company for July shows the following results:

	1894.	1893.	Inc. or Dec.	
Gross earn	$1,779,014	$1,867,378	D	$88,364
Oper. expen	986,001	1,082,067	D	96,066
Net earn	$793,013	$785,311	I	$7,702
Other income	60,179	90,394	D	30,215
Total income	$853,192	$875,705	D	$22,513
Charges	873,579	937,297	D	63,718
Deficit	$20,387	$61,592	D	$41,205

The returns for the railroad company for eight months are as below:

Gross earn	$12,841,077	$14,910,680	D	$2,069,603
Net earn	5,816,427	6,048,593	D	232,166
Charges	7,033,077	7,132,235	D	99,158
Deficit	1,216,650	1,349,657	D	133,007

Savannah, Americus & Montgomery.—The Supreme Court of Georgia has given a decision affirming the decree of the lower court, confirming the validity of the charter and bonds of the company. The decision was given on an appeal from the lower court in a case in which it was sought to prevent a foreclosure of the mortgage desired by the bondholders.

Southern Railway Co.—A meeting of the stockholders of this company will be held at Richmond, Va., Oct. 2. The stockholders will be asked to approve the execution of a mortgage to the Central Trust Co., of New York, upon all the property of the company, securing an issue of 5 per cent. bonds amounting to $120,000,000 as provided in the reorganization plan. Authority will also be secured to execute a mortgage upon part of the East Tennessee, Virginia & Georgia Railroad to secure 5 per cent. bonds amounting to $4,500,000, which it is proposed to issue in place of various equipment and income bonds secured by a mortgage recently foreclosed.

Union Pacific.—The receivers have decided to pay the overdue interest on the Utah & Northern first mortgage bonds, amounting to $154,700, and on the Utah & Southern extension bonds amounting to $34,370. President Clark states that the Union Pacific will continue to control the Oregon Short Line, through Judge River's recent decision.

Winona & Southwestern.—The foreclosure sale of this road under the first mortgage, in accordance with the decree dated March 13 last, will take place at Winona, Minn., on September 8. An attempt will be made by interests representing a majority of these bonds, of which $1,937,000 are now outstanding, to have the sale postponed beyond that date.

TRAFFIC.

Traffic Notes.

The roads in the Trunk Line Association have stopped the sale of unlimited tickets to points beyond Trunk Line territory. This action is taken because of the failure to effect an agreement with the railroads in the South and West for the regulation of the stop-over privileges.

The Union Pacific is said to be doing an extraordinary business in fruit shipments. Since July 15 over 167 special trains carrying California green fruit have gone over the line. The freght trains on the Wyoming division now average, it is said, about 10 trains a day, and the amount of freight business handled by the road is said to be without parallel. The Pennsylvania is doing a heavy business on its lines into Pittsburgh. On the Fort Wayne division last week, 47,161 tons of freight passed through Pittsburgh from the West, while on the previous week 43,992 tons were shipped, and that total showed an increase of nearly 2,000 tons over the first weeks in August.

Last month's freight movement through the Pennsylvania yards at Columbia, Pa., was the largest for August and the second largest for any one month in the history of the Philadelphia division. A total of 129,091 cars were moved, made up into 2,120 eastbound trains of 65,527 loaded and 1,261 empty cars and 944 westbound trains of 11,314 loaded and 51,314 empty cars. The total eastern movement was 66,527 and western 62,564. The largest monthly movement was 130,547 cars in March, 1893

The Fall River Line announces that its double service of boats between New York and Boston, which has been advertised to be operated until Sept. 8, will be continued until Sept. 15.

Chicago Traffic Matters.

CHICAGO, September 5, 1894.

Freight traffic is making steady gains and that there will be a considerable increase this month is generally believed.

Officials of the "grangers" continue to give out bear interviews regarding crop prospects, and a recent interview with general manager Whitman of the Northwestern, tends to confirm the earlier reports. He says: "I do not believe Nebraska will raise 25 per cent. of a corn crop. Other crops in that state are also short. Not a bushel of corn will be shipped east of the Missouri river. Iowa will not have more than 33 per cent. of corn crop, but has some small grain. South Dakota has practically nothing." Mr. Whitney says the short crops must produce scanty buying of supplies and a consequent poor merchandise traffic into those states. The Atchison report, out last week, says the failure of the corn crop in Kansas is the worst on record.

Lake rates remain firm and with slight advances on several days. East-bound shipments last week were considerably in advance of the previous week, principally in grain and mill-stuffs, of which there were about 9,000 tons more shipped than the previous week. West-bound tonnage continues to be monopolized by the soft coal trade, but supplies are gradually reaching the maximum and a decrease in the movement is likely to be noticeable soon. Should this tonnage be released this month rates are likely to slump during the last few weeks of the navigation season. New England rates on grain are to be advanced on September 10 to 10 cents on wheat, 9 cents on corn and 5¾ on oats.

Appearances strongly support the claim that the traffic men are determined to wipe out any possible profits which the eastern lines may make from any increase of business this year. As noted last week the Atchison in connection with the Erie, took the initiative in reducing rates on packing house product from the Mississippi River, alleging that thier competitors were secretly cutting the agreed rates. Strenuous efforts were made by the association officials to secure the withdrawal of the rate, without success, and on yesterday all roads openly reduced the 30 cent rate on packing house product and live hogs to 25 cents per 100 lbs. to New York and Boston, Philadelphia 23 cents, Baltimore 22, Buffalo 15. The rate on bulk meats was also reduced from 35 cents to 30 cents to New York, with corresponding reductions to other points. There is absolutely no defense for the reduction on any ground other than legitimate competition, and this in spite of the fact that the association has materially strengthened its agreement within the past year. The whole trouble originated, as was predicted at the time the Chicago and Peoria agreements were made, from the failure to include in the general agreement intermediate junction points between Chicago and St. Louis. A meeting of the general managers has been called for Friday at which efforts will be made to stop the impending demoralization. Should this fail, efforts will then be made to get the presidents together to take action. The situation is regarded with much appprehension.

Passenger rates are also in a precarious condition and will need attention as well. The regular bi-monthly meeting of the Central Traffic Passenger Association convened here to-day and the result of the general discussion of the situation will be communicated to the meeting of general managers on Friday. The conference having under consideration the resurrection of the Trans-continental Association, took a recess on Saturday and reconvenes to-day, when consideration of the report of the committee will be resumed. The outlook for the formation of a new association is not bright.

The Lake Erie & Western and the Pennsylvania are indulging in a passenger rate war on excursion business between Indianapolis and this city. The former ran an excursion on August 18, at $3.50 for the round trip, it is said, without the consent of the association and announced another for September 1, at $3. This stirred up the Pennsylvania, which promptly made a rate of $2. The Lake Erie retaliated with a rate of $1, and the Pennsylvania met it and also announced an excursion for $2, with a limit of 10 days, with the result that the rate promptly came down to 75 cents for the round trip. Prospective excursionists in that city are now waiting for an excursion with Pullman cars and free hotel accommodations at Chicago. The Pennsylvania did not go below a $1 rate for two days' limit, and $2 for ten days' limit, and carried over 5,000 passengers on Saturday. The Lake Erie & Western gets into Chicago by steamer from Michigan City, and were limited to 500. The Pennsylvania met the rate by an agreement with the Monon and the Big Four. The Lake Erie announces another excursion for September 8, and says it will charter the whaleback boat; probably the Monon will meet the rate this week with the same rates as made by the Pennsylvania.

Negotiations are pending for the running of excursions at $5 for the round trip from St. Louis to this city and return, during the present month. Some of the roads are holding off, fearing a demoralization of regular rates if this is done.

Chairman Caldwell is investigating reports of cut rates by the Macon & Georgia and the Hutchinson & Southern, claim being made that this market is stocked with tickets issued by both these roads.

Commencing September 15, the Chicago Great Western will put on an additional passenger train to St. Paul, Des Moines and Kansas City.

The western roads have extended the territorial limits of the harvest excursions to include Georgia, Florida, North and South Carolina, Arizona and New Mexico.

A joint conference of representatives of the passenger departments of the Trunk Line, Central Traffic and Western Passenger associations is to be held in connection with the meeting of general passenger agents comprising the American association, at Quebec, Sept. 18, at which will be considered the question of a change in divisions and the granting of the demand of the Chicago-Buffalo lines for excess mileage on through fares.

The Chicago, Milwaukee & St. Paul will "join the procession" in running cheap excursions, having announced an excursion from Savannah to Chicago and return, including intermediate points, for September 9, at $2 for the round trip.

Western lines will accept return portions of Grand Army tickets to the full limit of the tickets.

A general advance in freight rates to North Pacific coast points will be made by the Northern Pacific & Great Northern.

The action of the Soo line in cutting loose from the agreement to restrict the payment of mileage on freight cars to one-half cent, and returning to the three-fourths of a cent basis, is not calculated to increase the harmony between that line and the western roads, but will probably have no effect on the agreement. Western roads think that this action was instigated by the eastern lines who have refused to agree to the one-half cent basis, in the hope that it would break the agreement.

The shipments of east-bound freight, not including live stock, from Chicago, by all the lines, for the week ending September 1, amounted to 48,059 tons against 47,161 tons during the preceding week, an increase of 896 tons and against 50,149 tons for the corresponding week last year. The proportions carried by each road were:

ROADS.	WEEK TO SEPT. 1.		WEEK TO AUG. 25.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	5 836	12.0	6,411	13.6
Wabash	4,497	9.4	3,862	8.2
Lake Shore & Mich. South.	4,900	10.2	3,855	8.1
Pitts., Ft. Worth & Chicago.	5.455	11.4	4,702	9.9
Pitts., Cin., Chi. & St. Louis	5,649	11.6	5,994	12.7
Baltimore & Ohio	2,936	6.1	2,870	6.1
Chicago & Grand Trunk	4,652	9.7	4,746	10.1
New York, Chic. & St. Louis	5,555	11.6	5,627	11.9
Chicago & Erie	5,691	11.8	7,141	15.2
C. C. C. & St. Louis	2.988	6.2	1,953	4.2
Totals	48,059	100.0	47,161	100.0

Of the above shipments 1,586 tons were flour, 12,591 tons grain and mill stuff, 9,563 cured meats, 10,112 tons dressed beef, 1,426 tons butter, 1,987 tons hides and 6,316 tons lumber. The three Vanderbilt lines carried 33.8 per cent., the two Pennsylvania lines 23.0 per cent., Lake lines carried 56,123 tons against 45,724 tons last week.